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Hardware vs. Manpower Comparability Methodology

Overview and Manager's Guide
Volume 1

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May 1990

Manned Systems Group
Systems Research Laboratory

U.S. Army Research Institute for the Behavioral and Social Sciences

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Hardware vs. Manpower Comparability Methodology

Overview and Manager's Guide

Volume 1

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A Field Operating Agency Under the Jurisdiction
of the Deputy Chief of Staff for Personnel

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This volume addresses the planning and conducting of an HCM analysis. Procedures are provided for determining the analysis scope and estimating the resources required for the analysis. Preparation of the quality assurance plan and establishment of the consolidated database are explained. The relationship between HCM results and various Army MPT documents is also discussed.

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FOREWORD

The goal of the Army HARDMAN methodology is to provide timely information on the manpower, personnel, and training (MPT) resource requirements of emerging weapon systems. This information supports decisions on the research, development, and acquisition issues affecting emerging systems, as well as planning required for effective supportability of these systems in MPT and logistics areas. HARDMAN is a key element of the Army MANPRINT program.

This guide consists of seven volumes, a manager's guide and one volume for each of the six steps of the HARDMAN methodology. The manager's guide is intended for the use of the manager in the planning, scoping, and costing of the HARDMAN analysis. The other six volumes are for the analysts who will perform the analytic procedures in each step of the methodology.

This volume is the manager's guide. It deals with the planning and conducting of the HARDMAN analysis and the estimation of the resource requirements for the analysis. Development of the quality assurance plan and the consolidated database are explained. The relationship of HARDMAN results to various Army MPT documents is also discussed.

This guide is a major revision and expansion of the existing five-volume HARDMAN guide. The scope has been altered to include procedures for assessing combat damage workload and depot-level manpower requirements, and estimating training resource requirements associated with new training concepts and other procedures not included previously. Existing procedures have been clarified, simplified, or expanded to make them more useful to the analyst and to make HARDMAN a more effective tool for the Army.

The development of the guide was part of the System Research Laboratory's Third Generation MANPRINT Estimation Research Task. Most of the expansion and enhancement of the HARDMAN method has been based on recommendations of the Soldier Support Center, National Capital Region (SSC-NCR), which has overseen application of the method to numerous Army weapon systems. Staff from the SSC-NCR attended all the in-progress reviews for this effort and have been briefed on the final product. In addition, personnel from the TRADOC Analysis Command, White Sands Missile Range, TRADOC Headquarters, the U.S. Army Human Engineering Laboratory, and other Army agencies have been briefed on the revised HARDMAN guide to make them aware of its enhanced capability to provide MPT information for emerging systems.



EDGAR M. JOHNSON
Technical Director

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The seven-volume Hardware vs. Manpower (HARDMAN) Comparability Methodology (HCM) User's Guide is the product of a 15-month research-and-development contract. Dynamics Research Corporation (DRC) was contracted to conduct a number of analytic tasks to improve the Army's HARDMAN Comparability Methodology. The authors would like to acknowledge the efforts of the many contributors to this project.

The core group of analysts and authors included Mr. David Herlihy, principal investigator, Ms. Jane Bondaruk, Mr. Guy Nicholas, Mr. Robert Guptill, and Mr. John Park. Mr. Roger Collins of SIGMA Systems, Dr. Stuart Rakoff of Decision Science Consortium, Inc., and Dr. Wayne Copes of Copes and Associates contributed their expertise to several of the HCM product-improvement tasks.

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Finally, the authors would like to recognize the efforts of those who produced these seven volumes, including Mr. William Twomey, who managed this large-scale production effort, DRC's word processing department, under the supervision of Ms. Dianna DiGregorio, and Ms. Sharon Doherty, who produced the artwork.

HARDWARE VS. MANPOWER COMPARABILITY METHODOLOGY (OVERVIEW AND MANAGER'S GUIDE)
(VOLUME 1 OF 7)

CONTENTS

	Page
INTRODUCTION	xi
1. THE ARMY HARDMAN COMPARABILITY METHODOLOGY...AN OVERVIEW	1-1
1.1 What Is the Army Hardware versus Manpower (HARDMAN) Comparability Methodology?	1-1
1.2 The HCM's History	1-2
1.3 The Four Comparison Systems in an HCM Analysis.	1-4
1.4 The Six Steps of the HCM.	1-5
2. DEVELOPING THE HCM PLANNING DOCUMENT	2-1
2.1 Overview.	2-1
2.2 Part 1: Developing the New System Description.	2-1
2.3 Part 2: Developing an MPT Questions List	2-27
2.4 Part 3: Developing an HCM Analysis Plan.	2-29
2.5 Part 4: Estimating the Cost of an HCM Analysis	2-35
3. CONDUCTING AN HCM ANALYSIS	3-1
3.1 Overview.	3-1
3.2 HCM Quality Assurance Plan (QAP).	3-1
3.3 Establishing and Structuring the Consolidated Database (CDB).	3-23
3.4 Report Information.	3-23
3.5 HCM-MPT Document Crosswalks	3-26
APPENDIX A. ACRONYMS AND ABBREVIATIONS.	A-1
B. GLOSSARY.	B-1
C. REFERENCES FOR THE SEVEN HCM VOLUMES.	C-1
D. BLANK WORKSHEETS.	D-1

LIST OF TABLES

Table 1-1.	DRC's HCM analyses.	1-3
1-2.	Distinctions among the predecessor, baseline comparison, and proposed systems.	1-6
2.1-1.	HCM planning document outline	2-2

CONTENTS (Continued)

	Page
Table 2.3-1. Example of MPT questions list	2-28
2.5-1. Example of worksheet 1.	2-37
2.5-2. Example of worksheet 2.	2-39
2.5-3. Example of worksheet 3.	2-40
2.5-4. Example of worksheet 4.	2-42
2.5-5. Example of worksheet 5.	2-43
2.5-6. Example of worksheet 6.	2-45
2.5-7. Example of worksheet 7.	2-46
2.5-8. Example of worksheet 8.	2-47
2.5-9. Example of worksheet 9.	2-49
2.5-10. Example of worksheet 10	2-50
2.5-11. Example of worksheet 11	2-52
2.5-12. Example of worksheet 12	2-54
2.5-13. Example of worksheet 13	2-55
2.5-14. Example of worksheet 14	2-57
2.5-15. Example of worksheet 15	2-58
2.5-16. Example of worksheet 16	2-60
2.5-17. Example of worksheet 17	2-62
2.5-18. Example of worksheet 18	2-65
2.5-19. Example of worksheet 19	2-67
2.5-20. Example of worksheet 20	2-68
2.5-21. Example of worksheet 21	2-70
2.5-22. Example of worksheet 22	2-71
3.3.-1. Generic HCM data categories	3-24
3.3-2. Sample page from data source index.	3-25
3.5-1. HCM products.	3-27
3.5-2. HCM-MPT documents crosswalk for systems analysis.	3-28
3.5-3. HCM-MPT documents crosswalk for manpower.	3-30
3.5-4. HCM-MPT documents crosswalk for personnel pipeline analysis	3-32
3.5-5. HCM-MPT documents crosswalk for training.	3-33
3.5-6. HCM products that meet ASARC requirements	3-36

LIST OF FIGURES

Figure 1-1. Steps in the HARDMAN comparability methodology.	1-7
3.2-1. Quality assurance plan.	3-2

SECTION 1

THE ARMY HARDMAN COMPARABILITY METHODOLOGY . . . AN OVERVIEW

1.1 WHAT IS THE ARMY HARDWARE VERSUS MANPOWER (HARDMAN) COMPARABILITY METHODOLOGY?

The Army HARDMAN Comparability Methodology (HCM) is a six-step process for determining a weapon system's manpower, personnel, and training (MPT) requirements. The HCM is an integral part of the Army's Manpower and Personnel Integration (MANPRINT) program. MANPRINT's objective is to integrate human factors engineering; manpower, personnel, and training (MPT); health hazard assessment; and system safety to improve soldier performance and total system performance throughout the materiel-development process.

An HCM analysis of an emerging or existing weapon system provides the following:

- **Answers to MPT Issues and Questions:** The HCM provides Army decision makers with estimates of a system's MPT requirements in the early phases of the acquisition process, when this information can have the greatest impact on system design.
- **Identification of High-Resource Drivers:** HCM results can identify design characteristics, operational/support concepts, and policies that could strain the Army's resources.
- **Estimates for Resource Planning:** HCM provides early estimates of manpower and training requirements to allow resource planners adequate lead time for budget preparation. HCM MPT results can provide input to Army costing and personnel projection systems.
- **Tradeoff Analysis:** HCM results can be used in tradeoff analyses of equipment and human resources during the early stages of system acquisition. Such analyses ensure that human supportability considerations are a part of system performance and cost analyses.
- **A Documented Audit Trail:** The MPT analysts develop a record of findings throughout an HCM analysis. This record can be used to modify and challenge data and assumptions.

The HCM is an iterative process that can accommodate changes to system concepts and parameters throughout the acquisition process. Once Army MPT analysts have completed a basic HCM analysis, they can use the methodology to examine the impact of alternative designs and concepts on the system's MPT requirements.

1.2 THE HCM'S HISTORY

In the early 1980s, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) began to study MPT issues in weapon system development. ARI realized that the Army needed a structured technique for assessing a weapon system's MPT requirements. ARI reviewed two existing techniques, the Air Force's Coordinated Human Resource Technology (CHRT), later known as the Acquisition of Supportable Systems Evaluation Technology (ASSET), and the Navy's HARDMAN Methodology. ARI chose the Navy HARDMAN Methodology as the foundation for an Army MPT estimation tool because it had been tested and proven with actual weapon systems.

The National Aeronautics and Space Administration's Jet Propulsion Laboratory (JPL) evaluated the Army HCM in 1983. This evaluation indicated that the methodology was useful, analytically sound, and well received by users.

The HCM has been applied to many Army weapon systems, including those listed in Table 1-1. These analyses have provided Army decision makers with significant results. For example, an HCM analysis of an Army helicopter showed that one MOS was overburdened with maintenance tasks. The analysis results indicated that future system modifications could be adversely affected if the maintenance tasks were not distributed to another MOS. An HCM analysis of another Army helicopter revealed that the system would require 27 percent more soldiers with a higher skill level than its Predecessor System (i.e., "skill creep"). An HCM analysis of an armored vehicle showed that a reduction in crew size from four soldiers to three would reduce manpower by approximately 25 percent but would not reduce the system's personnel requirements.

1.2.1 The HARDMAN Product Improvement Program

In 1986 ARI embarked on an HCM Product Improvement Program (PIP). ARI, with assistance from the Soldier Support Center-National Capital Region (SSC-NCR), developed the PIP based on lessons learned in past HCM applications. The methodology now includes new, expanded, and refined procedures. The PIP's objectives are summarized below.

During the HCM applications, users posed questions that were beyond the scope of the original HCM. The PIP added eight new procedures to the HCM to assess the following requirements:

- Combat damage workload
- Depot-level manpower
- Unit training resources
- Aptitude and mental category
- Unit supply manpower
- New training concepts
- System deployment and retirement manpower
- Reserve component manpower

Table 1-1. DRC's HCM Analyses

Enhanced Self-Propelled Artillery Weapon System (ESPAWS)
Division Support Weapon System (DSWS) 2 Iterations
Corps Support Weapon System (CSWS)
Single Channel Ground-Airborne Radio System (SINCGARS)
Army Remotely Piloted Vehicle (RPV) 3 Iterations
Marine Corps Remotely Piloted Vehicle (RPV)
Howitzer Improvement Program (HIP)
Advanced Field Artillery Tactical Data System (AFATDS)
All Source Analysis System (ASAS)
Apache II (AH-64B)
Armored Gun System (AGS)
Army HAWK (PIP-III) Air Defense System
Elevated Target Acquisition System (ETAS)
Firefinder II
Laser Countermeasure System (STINGRAY)
Light Air Defense System (LADS)
Light Helicopter Experimental System (LHX)
Patriot Air Defense System
Sgt. York Air Defense System
Short Range Air Defense Command and Control System (SHORAD C²)
BLACK HAWK
Chinook (CH-47)

HCM users also required additional structured guidance to perform existing HCM procedures. The PIP produced structured procedures in the following areas:

- Functional requirements
- Comparability analysis judgments
- Tradeoff selection and decision making
- MOS selection
- Managing an HCM analysis

Users felt that HCM results should be better integrated with Army MPT procedures and requirements, for example, the Cost and Training Effectiveness Analysis (CTEA), Basis of Issue Plan (BOIP), and Qualitative and Quantitative Personnel Requirements Information (QQPRI). The HCM includes detailed MPT document to HCM product crosswalks that integrate the HCM with the MPT document process.

Army users felt that results produced by the HCM personnel model were overstated. The users needed a better explanation of the HCM personnel model, and needed to understand how it compared with the Army's other personnel models. In the PIP, the personnel step was completely rewritten to clarify the existing model.

1.3 THE FOUR COMPARISON SYSTEMS IN AN HCM ANALYSIS

During an analysis, HCM analysts develop four comparison systems. The analysts must define the "New System," its "Predecessor System," a "Baseline Comparison System (BCS)," and one or more "Proposed Systems."

The New System is the system being studied in the HCM analysis. The HCM analysts must define the New System's design, performance, and support requirements.

The Predecessor System is the fielded system currently performing the functions required of the New System; it is the system being improved or being replaced by the New System.

The Baseline Comparison System is a composite of current operational systems that approximate the New System in terms of design, operation, and support. HCM analysts use a technique known as "comparability analysis" to develop the BCS. In comparability analysis, MPT analysts use information about existing weapon systems to project the New System's MPT requirements.

The engineering analyst uses comparability analysis to identify the pieces of equipment that most closely meet the New System's performance and design requirements. These components can be drawn from the Predecessor System and from other comparable existing systems in the Army, Department of Defense (DoD), North Atlantic Treaty Organization (NATO), and civilian inventories.

The manpower analyst uses comparability analysis to identify the Military Occupational Specialties (MOSs) that will operate and maintain the New System. The personnel analyst uses comparability analysis to identify comparable flow rates for new or unstable MOSs. The training analyst uses comparability analysis to identify comparable tasks and courses in order to project training cost and resources.

The analysts' objective in developing the BCS is to meet the New System's performance and design requirements. The analysts may have difficulty achieving this objective if the New System uses a new technology for which no historical data are available. The analysts compensate for this deficiency by developing the Proposed System.

The Proposed System is an analytical construct that represents the New System's design. As with the BCS, the analyst develops the Proposed System by identifying specific hardware components that perform New System functions. Unlike the BCS, however, the Proposed System must meet all New System requirements. The number of Proposed Systems typically reflects the number of major technological approaches being considered or the number of unique design solutions offered by competing materiel contractors.

Table 1.2 summarizes how the Predecessor System, BCS, and Proposed System differ.

1.4 THE SIX STEPS OF THE HCM

The HCM consists of six interrelated steps. These six steps, which are shown in Figure 1.1, are:

Step 1, Systems Analysis: The engineering analyst establishes the foundation for the entire analysis by defining the Predecessor System, the Baseline Comparison System, and the Proposed System.

Step 2, Manpower Requirements Analysis: The manpower analyst determines the New System's qualitative and quantitative manpower requirements.

Step 3, Personnel Pipeline Analysis: The personnel analyst estimates the personnel pipeline needed to support the New System's workload-driven manpower requirements.

Step 4, Training Resource Requirements Analysis: The training analyst estimates training cost and resource requirements, including training man-days, course costs, graduate costs, course length, and instructor requirements.

Step 5, Impact Analysis: The HCM analysts study the impact of the New System's projected MPT requirements on available MPT resources. The results indicate New System characteristics that will require management attention throughout the acquisition process.

Step 6, Tradeoff Analysis: The HCM analysts identify alternatives that may reduce the New System's MPT requirements.

Table 1-2. Distinctions Among the Predecessor, Baseline Comparison, and Proposed Systems.

SYSTEM	<u>SATISFIES SYSTEM FUNCTIONAL REQUIREMENTS?</u>			
	<u>WHAT</u>	<u>HOW WELL</u>	<u>TECHNOLOGY</u>	<u>STATUS</u>
Predecessor	Majority	Many Deficiencies	Existing - Outdated/Obsolete	Deployed/Obsolete DoD/NATO
BCS	All	Some Deficiencies	Current - State of the Art	Mature
Proposed	All	Few Deficiencies	Future - Emerging, Low-Risk	Immature
				<ul style="list-style-type: none"> • Engineering Estimates • OT/DT Test • Lab test • Comparability Extrapolation from BCS Data

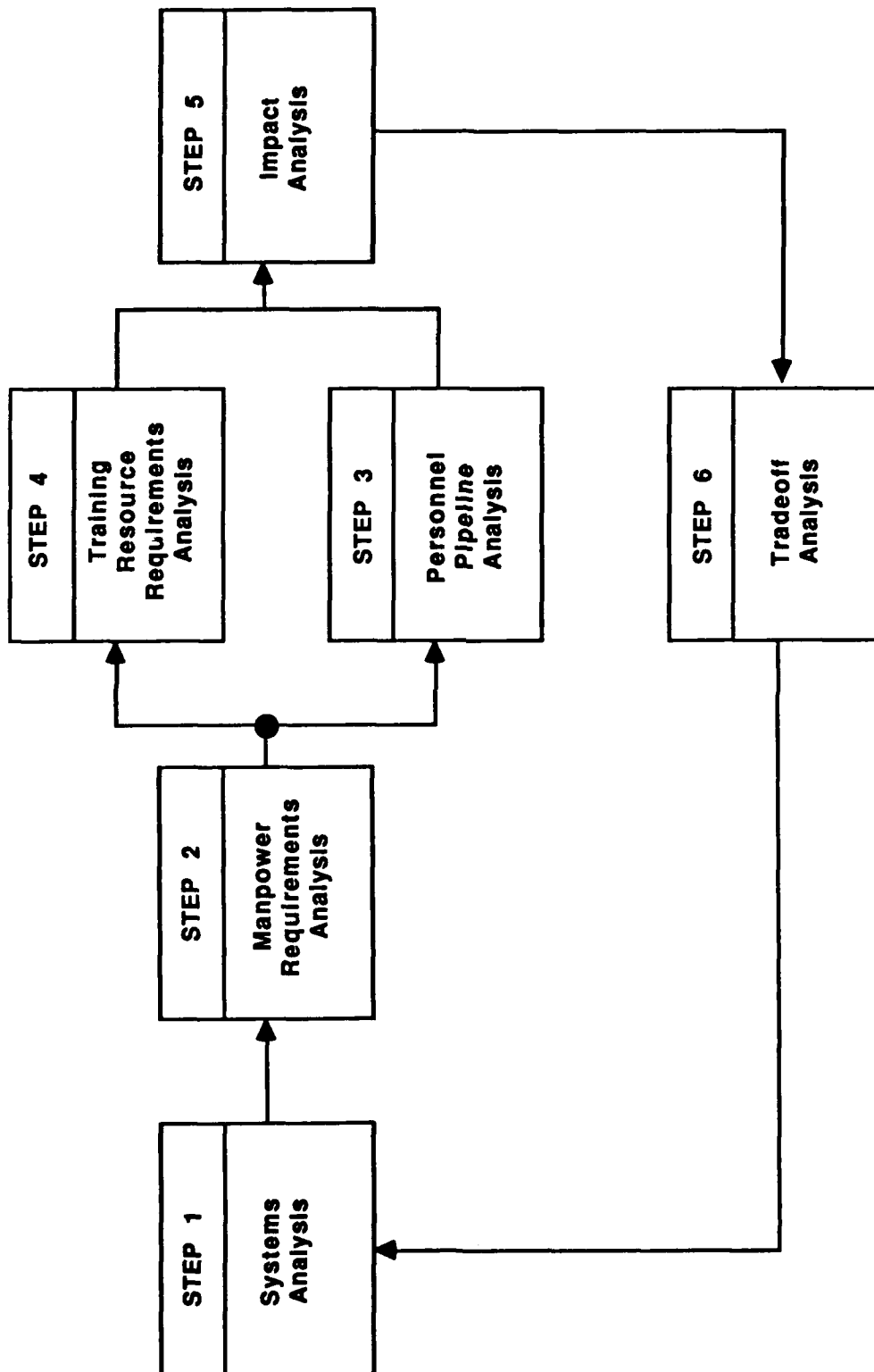


Figure 1-1. Steps in the HARDMAN Comparability Methodology.

SECTION 2

DEVELOPING THE HCM PLANNING DOCUMENT

2.1 OVERVIEW

Careful planning is a key to success in a HARDMAN Comparability Methodology (HCM) analysis. Before an HCM analysis can be conducted, its objectives must be clearly defined. In this section the Estimator* develops a document that provides comprehensive information about the analysis.

The "HCM Planning Document" contains four parts, as outlined in Table 2.1-1. In Part 1 the Estimator defines the New System. He or she then develops Part 2 of the document, which lists MPT questions that the HCM analysis must address. This list will help the Estimator complete Part 3, the analysis plan, which he or she uses to determine the scope of the analysis. After the Estimator determines the analysis scope, he or she estimates the cost of the analysis (Part 4).

If the Estimator determines that the necessary resources (time and/or money) are not available to perform the analysis as planned, he or she must "tailor" the analysis to the available resources. The primary tailoring task is to reconsider the list of MPT questions. The Estimator should determine what MPT information is important and what information is unnecessary. The Estimator may find that a narrower analysis scope will adequately answer the most critical MPT questions.

Scoping an analysis leads the Estimator through a top-down approach to establishing the requirements and costs of the analysis. Tailoring involves bottom-up adjustments that reconcile MPT information needs with resources available for the analysis.

2.2 PART 1: DEVELOPING THE NEW SYSTEM DESCRIPTION

Part 1 consists of 13 "system parameters" that define the New System. System Parameters 1 through 5 are broad parameters that address New System materiel commodities, maintenance concept, acquisition strategies and milestones, and the system boundary.

* Editor's Note: The term "Estimator" refers to the person(s) planning the HCM analysis. An analysis can be planned by an Army Technical Advisory Group (TAG), a MANPRINT action officer, and/or an HCM analysis team.

Table 2.1-1. HCM Planning Document Outline

PART 1: SYSTEM DESCRIPTION

1. Materiel Commodities
2. Maintenance Concept
3. Acquisition Strategy
4. Acquisition Milestones
5. System Boundaries
6. Missions
7. Acquisition Goals and Constraints
8. Alternative Platforms and Proposed Systems
9. Equipment
10. Operational Concept (Usage Rates)
11. MOSs
12. Units
13. Training Concept

PART 2: MPT QUESTIONS LIST

PART 3: HCM ANALYSIS PLAN

Section 1: System Parameters

1. Materiel Commodities
2. Maintenance Concept
3. Acquisition Strategy
4. Acquisition Milestones
5. System Boundaries
6. Missions
7. Acquisition Goals and Constraints
8. Alternative Platforms and Proposed Systems

Table 2.1-1. HCM Planning Document Outline (Con't.)

9. Equipment
10. Operational Concept (Usage Rates)
11. MOSs
12. Units
13. Training Concept

Section 2: Additional Analysis Procedures

1. Predecessor System Definition and Analysis
2. Combat Damage Assessment
3. Reserve Manpower Requirements
4. Deployment/Retirement Manpower Requirements
5. Task Comparability Analysis
6. Unit Training Product Requirements
7. Aptitude and Mental Category Requirements
8. Course Material Requirements

PART 4: ANALYSIS COST WORKSHEETS

System Parameters 6 through 13 provide more specific information about the New System. These parameters address the New System's missions, alternative platforms, equipment, acquisition goals and constraints, operational concept, MOSs, units, and training concept. (HCM Substeps 1.1 through 1.5, 2.1, 2.2, and 4.1 discuss the latter parameters. The Estimator may wish to refer to these substeps while he or she completes Part 1.)

The Estimator must describe each system parameter as thoroughly as possible because he or she will use this information later to fill out the HCM analysis plan and to estimate the cost of the analysis.

The following pages describe how to complete Part 1 of the planning document. The pages include a discussion and procedures for each parameter and an example featuring the FIREFINDER II (FFII) radar system.

SYSTEM PARAMETER 1: MATERIEL COMMODITIES

DISCUSSION

A materiel commodity is a category of items and equipment. The number of materiel commodities in an analysis depends on the New System's requirements. The number of commodities affects the amount of equipment and the numbers of MOSs that will be associated with the New System. A target-processing system, for example, may require only components from communications and electronics commodities. Adding a maneuver requirement would create a need for propulsion, fuels, and mechanical engineering commodities.

PROCEDURES

1. Estimate the number and type of materiel commodities that the New System will use.
2. Record these materiel commodities in Part 1 of the planning document.

EXAMPLE

Materiel Commodities: The FIREFINDER II radar system uses the following materiel commodities:

- Command and Control
- Radio
- Electronics (Radar)
- Electronics (PLRS)
- Radar Vehicle
- ECM Gear
- NBC Gear
- Leveling Gear
- Generators (APU)
- Logistics Vehicle
- Shelter
- Control Environment
- Crew Stations
- Test Equipment

SYSTEM PARAMETER 2: MAINTENANCE CONCEPT

DISCUSSION

The New System's maintenance concept describes the maintenance levels that will be associated with that system. The number of New System maintenance levels determines how many mechanics and repairers (MOs) the HCM analysts will examine. The number of maintenance levels will also affect the amount of work the engineering and manpower analysts must do to calculate and aggregate maintenance workload.

The Estimator must consider the maintenance concepts of the Predecessor System and the BCS components. If the HCM analysts collect data for components with a maintenance concept that is different from the New System's, they must convert the data to reflect the New System's maintenance concept.

TRADOC Pam 525-27-3, U.S. Army Operational Concept for Three-Level Maintenance, contains the Army's maintenance concept. This publication lists the following maintenance levels:

- (1) Unit Maintenance - performed by operator/crew, Company maintenance teams.
- (2) Intermediate Maintenance - performed as either or both:
 - Intermediate Direct Support (DS), Division level, or
 - Intermediate General Support (GS), Corps level.
- (3) Depot - performed at either or all:
 - Army Materiel Command depots,
 - Contractor facilities, or
 - Host nation support (HNS) facilities.

TRADOC Pam 525-27-3 lists variations of this basic three-level maintenance concept for missile maintenance, engineer units, medical units, and others. The TRADOC Pam specifically excludes Aviation maintenance because this maintenance conforms to the required three-level-maintenance structure. The Aviation maintenance structure is:

- (1) Aviation Unit Maintenance (AVUM);
- (2) Aviation Intermediate Maintenance (AVIM); and
- (3) Depot.

The Estimator should note that different Army groups use different terms to refer to the same maintenance levels. The HCM analysts should report their results in terms appropriate to the user group. The Estimator should seek the help of subject-matter experts (SMEs) to determine the number of maintenance levels and the name used to specify each level. He or she should also understand that the Army considers crew maintenance part of unit maintenance. (In Aviation there is no "crew" maintenance per se; however, some crew chiefs who fly also perform maintenance activities.)

The Estimator must document issues such as the use of Test Measurement and Diagnostic Equipment (TMDE) and maintenance "passback" strategies. The use of TMDE; Built-In Test (BIT); Built-In Test Equipment (BITE), or plans to pass a certain amount of maintenance from Division-level maintenance to Corps-level maintenance facilities will affect the HCM analysis results.

PROCEDURES

1. Identify the New System's maintenance levels using fielding plans, O&O Plans, and other documents.
2. Use the New System documents to determine the New System's maintenance concept, e.g., passback maintenance strategies, modular remove and replace, etc.

OR

If the New System does not have a maintenance concept, estimate this concept after consulting SMEs.

3. Record the New System's maintenance levels and maintenance concept in Part 1 of the planning document.

EXAMPLE

Maintenance Levels: The FFII will be maintained at three levels:

- Intermediate Forward;
- Intermediate Rear; and
- Depot.

Maintenance Concept: The FIREFINDER is supported by the Army three-level maintenance concept. Standard tools and TMDE will be used for the system. The maintenance concept is modular (replace when faulty). BIT allows the operator/maintainer to isolate faults and correct them by replacing Line Replaceable Units (LRUs) and Printed Circuit Boards (PCBs). Intermediate maintenance personnel will use spare parts from the Authorized Stockage List (ASL) to isolate and repair the remaining faults.

Unit maintenance will include remove and replace to facilitate rapid turnaround. Unit-maintenance tasks will include Preventive Maintenance (visual inspection, testing, cleaning, tightening/adjusting, minor adjustments); making external adjustments on equipment; performing operational checks and adjustments using standard tools and test equipment; and using BIT to analyze/trace equipment malfunctions to the defective re-

placeable module or component. Unit personnel can replace modules when Maintenance Allocation Charts (MAC) authorize such replacements. All unserviceable modules will be returned to intermediate maintenance units for disposition. Faulty modules will be forwarded to the Special Repair Activity or depot for repair.

Two Mobile Support Teams (MST) assigned to the headquarters and Light Maintenance Company of the Division Maintenance Battalion will provide intermediate maintenance (DS) at the Division level. The MSTs will be capable of locating faulty wiring, cabling, and connectors and malfunctioning PCBs, modules, replaceable units, hydraulics or end items. The MSTs may also repair selected components and end items. The Maintenance Company of the Support Battalion will provide intermediate maintenance in the separate Brigades. The Corps Target Acquisition Battalion (TAB) will provide intermediate maintenance in the Corps.

Intermediate maintenance (GS) will involve the classification of faulty parts/components/cards, etc., and the repair of selected items. Unserviceable components will be tested to determine whether they can be repaired. If they cannot be repaired, they will be disposed of in accordance with applicable regulations. Items requiring depot repair will be forwarded to depot. Depot maintenance involves the complete overhaul and reconditioning of major end items and assemblies.

SYSTEM PARAMETER 3: ACQUISITION STRATEGY

DISCUSSION

An acquisition strategy is the method a Program Office selects for acquiring a new weapon system. The Army can use one of three strategies to acquire a system: Developmental System Acquisition, Non-Developmental Item (NDI), and Product Improvement Program (PIP).

Developmental System Acquisition is the most common acquisition strategy. Under this strategy, the Program Office solicits industry for feasible concepts, and industry responds by proposing system designs that meet the Program Office's needs. Under the Non-Developmental Item (NDI) acquisition strategy, the Army fulfills a materiel need with a commercially available technology. In a Product Improvement Program (PIP), the Army procures an improved version of an existing system.

An acquisition strategy may specify a phased approach to system improvements; in other words, certain equipment is improved before other equipment is. Such phased improvements eventually affect all of the system's MOSs and parameters, but not at the same time.

PROCEDURES

1. Use available Army documents to determine the New System's acquisition strategy.
2. Record this strategy in Part 1 of the planning document.

OR

If available documents do not provide the acquisition strategy, consult New System SMEs and select the most likely acquisition strategy.

EXAMPLE

Acquisition Strategy: As currently defined, the FIREFINDER II program is a block approach Product Improvement Program (PIP) that will result in a single system to replace the two current FIREFINDER radars (AN/TPQ-36 and -37). The block approach is:

- Block 0 - Current, approved PIP
- Block I - CUCV, Light Division Quick Fix (NOTE: Block I has been canceled)
- Block II - Existing AN/TPQ-36 radar, crew shelter, and power source loaded on a five-ton truck (single vehicle)
- Block III - Improved Radar
- Block IV - Improved Mobility (New Vehicle)

SYSTEM PARAMETER 4: ACQUISITION MILESTONES

DISCUSSION

Acquisition milestones are important landmarks and dates during a system's acquisition. Broadly speaking, these milestones represent the acquisition schedule.

Acquisition milestones can affect an HCM analysis. The TAG may request that the analysis be accelerated so that the results can be used at certain system acquisition milestones, for example, Army System Acquisition Review Council (ASARC) review meetings. The Estimator must document the acquisition milestones in Part 1 of the planning document to ensure that the program's schedule is considered in Part 3, the analysis plan. The Estimator must also document the materiel fielding plan because the New System's deployment schedule and the Predecessor System's retirement schedule are important input to certain HCM substeps.

PROCEDURES

1. Use available schedules to determine major acquisition milestones.
2. Record these milestones in Part 1 of the planning document.

OR

Estimate the schedule if a schedule does not exist.

OR

If appropriate, state in the planning document that acquisition milestones will not affect the analysis.

EXAMPLE

Acquisition Milestones: FIREFINDER II

April 1981 - ASARC mandated enhanced survivability for AN/TPQ-37

March 1984 - VCSA-approved concept

September 1984 - LRRDAP funding approved

October 1984 - Desired Product Improvement Program submitted

January 1985 - Draft O&O Plan

May 1985 - HQ TRADOC-approved PIPs

December 1985 - O&O Plan approved

January 1986 - Letter of Agreement drafted

August 1986 - ROC drafted

May 1987 - ROC submitted for approval

June 1993 - IOC of Block III improved FFII

June 1995 - IOC of Block IV improved FFII

SYSTEM PARAMETER 5: SYSTEM BOUNDARIES

DISCUSSION

There are three system boundaries: development, operational, and force structure.

The development boundary is the narrowest boundary. It limits the system definition to the system being developed by the Army materiel developer. The development boundary does not include support equipment, test equipment, or platforms. The developmental boundary can usually be identified with assistance from the Army Materiel Command (AMC) Program Office.

The operational boundary is broader than the development boundary. It includes all components required to make up an autonomous entity under combat operations. "Autonomous" means that the operational boundary should include most, if not all, of the elements (e.g., support equipment such as vehicles and generators) the New System requires to function on the battlefield. The Estimator can use the New System's O&O Plan, BOIP, and Qualitative and Quantitative Personnel Requirements Information (QQPRI) to determine the New System's operational boundary.

The force structure boundary describes those units of the Army's force structure to which the New System will be fielded. The Estimator must remember that an HCM analysis is system-specific, and that the system under analysis may be fielded to units that include and support other systems. The Estimator should verify the force structure boundary with the proponent's Directorate of Combat Development (DCD). If the Estimator can document the fielding plan for the entire force structure, he or she should record it in the planning document.

PROCEDURES

1. Use available documents to determine the New System's development, operational, and force structure boundaries.
2. Record these boundaries in Part 1 of the planning document.

EXAMPLE

System Boundaries: The FFII's developmental boundary is the new target-locating radar system. This phased array radar system will replace both the AN/TPQ-36 and AN/TPQ-37. The radar on the FFII will serve both functions, operating as a mortar-locating radar and as a tube- and missile-artillery-locating radar.

The FFII's operational system boundary is the complete and mission-capable FIREFINDER section. The FFII section will be one of the assets in a Division Artillery (DIVARTY) Target Acquisition Battalion (TAB). The FFII section consists of the target acquisition radar, mounted on a vehicle (vehicle may vary in Heavy and Light Divisions), self-contained power generation unit, self-contained environmental units, and a separate logistics vehicle (a HMMWV). The FFII's crew consists of a Warrant Officer, a crew chief, and three crew members.

The FFII's force structure boundary encompasses all FFII sections and the supporting maintenance assets in each of the units to which the FFII will be fielded. The current force structure plans for the FFII are:

- Four FFII sections in each of the 10 heavy Divisions;
- Four FFII sections in each of the 8 light Divisions;
- One FFII section in each of the 3 separate Brigades; and
- Five FFII systems to the TAB at Ft. Sill, OK.

SYSTEM PARAMETER 6: MISSIONS

DISCUSSION

In an HCM analysis, the term "mission" refers to the system's objective in a mission area. A mission area (e.g., Target Acquisition or Air Defense) is a family of missions. TRADOC Regulation 11-8 (Combat Development Studies) and HCM Substep 1.1 provide further information about mission areas.

PROCEDURES

1. Use available Army documents to determine the New System's mission area or areas.
2. Divide the mission area into logical categories to determine the New System's specific missions. A mission area can be divided according to the New System's battlefield activities. The mission area can also be divided according to the battlefield activities' outcomes of the process. These outcomes can be found in doctrinal literature, for example, the how-to-fight field-manual series.
3. Record the New System's missions in Part 1 of the planning document.

EXAMPLE

Missions: The FFII's mission area is Fire Support. The FFII must locate and identify enemy mortars, artillery, and rockets, and link with other field artillery systems to provide the maneuver commander with a real or near real-time view of the enemy's indirect firing locations. The FFII has one primary mission: Locate and provide critical information on potential targets.

SYSTEM PARAMETER 7: ACQUISITION GOALS AND CONSTRAINTS

DISCUSSION

Acquisition goals are usually performance goals that the New System must achieve, for example, the system must be able to achieve a certain speed.

An acquisition constraint is a characteristic of the acquisition that could restrict the system in some manner; for example, the crew size cannot exceed a certain number. An acquisition program may also be constrained by time or money. Cost constraints may limit the system's complexity. Acquisition-time constraints may affect the procurement strategy. Substeps 1.2 and 1.3 of HCM Step 1 discuss acquisition goals and constraints.

PROCEDURES

1. Use available Army documents to determine the New System's acquisition goals and constraints.

OR

If available documents do not list goals and constraints, interview New System SMEs and estimate the weapon system's acquisition goals and constraints.

2. Record these goals and constraints in Part 1 of the planning document.

EXAMPLE

Acquisition Goals and Constraints: The FIREFINDER II must:

- Be capable of worldwide deployment.
- Be tactically deployable by C-130 or larger aircraft in a drive-on/drive-off mode.
- Be externally transportable via CH-47 helicopter for 30 km at an altitude of 4,000 feet at 95 degrees Fahrenheit.
- Be transportable by highway, rail, and later with lifting and tie-down provisions in accordance with MIL-STD 209.
- Be capable of operating in all types of climates.
- Be unaffected by climate to the same degree as the maneuver forces that it supports.
- Operate under battlefield conditions such as smoke; dust; electronic counter-measures (ECM); nuclear, biological, and chemical (NBC) environment; and directed energy.
- Operate 24 hours a day with a crew of four.
- Be capable of operation from a remote position.
- Be capable of self-leveling and self-survey.
- Have a throughput of 50-100 targets per minute.

- Be capable of processing and transmitting data while stationary or moving.
- Be capable of identifying targets by type and subtype.
- Have an information destruction capability.
- Have a radar range of __ km.*
- Be mounted on a single vehicle with an accompanying reconnaissance/logistical vehicle.
- Use standard Army radios.
- Have a portable night-vision device.
- Be capable of operating in directed energy, NBC, and light ballistic environments.
- Operate with a low probability of intercept by threat electromagnetic detection devices.
- Operate in active Electronic Countermeasures (ECM) environment.
- Have on-board power sources.
- Have an on-board position/navigation system.
- Be capable of emplacement, operation, and march order within __ minutes.*
- Be capable of transmitting and receiving data via secure digital communications.
- Be capable of interface with all fire support systems via secure voice communications and the chain of command.

* Classified

SYSTEM PARAMETER 8: ALTERNATIVE PLATFORMS AND PROPOSED SYSTEMS

DISCUSSION

A platform is a major end item, a final combination of products, that is ready for its intended use. Platforms are usually self-sufficient and involve a number of commodities. Some weapon systems can be used on different platforms. For example, a weapon system could be mounted on a five-ton truck in Light Divisions, on a tracked chassis in Heavy Divisions, or on a helicopter in Aviation and Cavalry units.

The Proposed System is an analytical construct developed to represent the best estimate of the design of the New System. The number of Proposed Systems reflects the number of major technological approaches being considered or the number of unique design solutions offered by competing materiel contractors. Substep 1.2 of HCM Step 1 describes Proposed System alternatives.

If the Proposed System alternatives differ, the Estimator must judge whether multiple BCS configurations are needed to represent these alternatives. For example, if one Proposed System is a wheeled vehicle and another is a tracked vehicle, the HCM analysts must develop separate wheeled and tracked BCSs and Proposed Systems for each alternative.

PROCEDURES

1. Determine the number of New System designs or concepts.
2. Determine the conceptual design(s) required to represent the technological advances and new operating and support concepts that are likely to be in the design of the New System.
3. Record the alternative platforms and Proposed Systems in Part 1 of the planning document.

EXAMPLE

Alternative Platforms and Proposed Systems: The FIREFINDER II radar has three platforms (vehicles):

- Five-Ton Truck;
- Trailing Arm Drive Vehicle (TADV); and
- Multiple Launch Rocket System (MLRS) Chassis.

Each platform is a Proposed System alternative.

SYSTEM PARAMETER 9: EQUIPMENT

DISCUSSION

The Estimator must determine the amount of equipment in the New System. An accurate estimate of the New System's equipment will yield an accurate HCM cost estimate. The engineering analyst develops a detailed equipment list in Substep 1.4.

PROCEDURES

1. Obtain an equipment list at the level desired for the analysis. If a system is well into the development cycle, the system's equipment list may be more detailed than necessary. If the list is too detailed, list the major subsystems only.

OR

Use the number and type of materiel commodities (Parameter 1) to develop a high-level generic equipment list.

2. List the New System's equipment in Part 1 of the planning document.

EXAMPLE

Equipment: The FIREFINDER II has 32 generic components:

- COMSEC equipment
- Signal processing unit
- Magnetic tape unit
- Line printer
- Communication equipment
- Radio
- Telephone
- Azimuth drive assembly
- Radar vehicle
- Logistics vehicle
- Leveling system motor
- Leveling system control unit
- Power generation system
- Power supply assembly
- Auxiliary electrical control panel
- Auxiliary electrical equipment

- Operational power distribution unit
- Shelter
- Operator controls/display
- Operator control group
- Environmental control unit
- Built-in test equipment
- Radar power distribution unit
- Microwave assembly
- Receiver/exciter group
- Transmitter
- Antenna transceiver
- Antenna group
- Phased array antenna group
- Elevation drive assembly
- Internal position/navigation system

SYSTEM PARAMETER 10: OPERATIONAL CONCEPT (USAGE RATES)

DISCUSSION

The operational concept describes how the New System will be used. The Army states a system's operational concept in the Organizational and Operational (O&O) Plan or the Operational Mode Summary. The Estimator can derive usage rates from these operational plans. A usage rate consists of a numeric value indicating the amount of usage; a usage description or dependency; and a time period, for example, 560 rounds per week. The numeric value is 560; the usage description is rounds; and the time period is a week.

Usage rates are important later in the HCM analysis because they will be used to determine maintenance workload. The Estimator must determine how many usage rates should be applied to the New System and must also determine their values. Substep 1.5 of HCM Step 1 discusses usage rates in greater detail.

PROCEDURES

1. Determine the system's operational concept and then develop usage rates by reviewing the Mission Profile/Operational Mode Summary and the O&O Plan.
2. Record these usage rates in Part 1 of the planning document.

EXAMPLE

Operational Concept: The FIREFINDER II is organized to provide independent weapons-locating support to field artillery headquarters. It will be employed in the Active Army to replace the current AN/TPQ-36 and AN/TPQ-37. In Heavy Divisions, the FIREFINDER II will be assigned to the TAB in the Division Artillery (DIVARTY) and allocated to subordinate units. Each Heavy Division will contain four radars per Division. In the Light Divisions, three FIREFINDER II radars will be assigned to the Headquarters and Headquarters Battery (HHB) of the DS Artillery Battalions and one radar will be assigned to the DIVARTY. Four radars will be assigned to each Light Division. One radar in each of the three Separate Brigades will be assigned to the Headquarters and Headquarters Battery (HHB) of the DS Artillery Battalion. At the Corps level, 18 radars will be organic to the Corps TABs and will be allocated to Divisions and Brigades, as necessary. A total of 80 FIREFINDER II systems will be deployed to the Active Army forces.

FIREFINDER II has six usage rates:

<u>WEEKLY USAGE RATE*</u>	<u>USAGE RATE DESCRIPTIONS</u>
58.80 (Hours)	Total Time (COMM Equip, etc.)
54.05 (Hours)	Radiate/Transmit Time (Radar Equipment)
4.75 (Hours)	Move Time (Radar Vehicle)

**WEEKLY
USAGE RATE***

**USAGE
RATE DESCRIPTIONS**

24.72 (Miles)

Move Distance (Logistics Vehicle)

9.50 (Hours)

Move Time (Logistics Vehicle)

49.44 (Miles)

Move Distance (Logistics Vehicle)

According to the O&O Plan, dated December 1985, FIREFINDER II will be used in four different types of operational modes. Close-in battle accounts for 80% of FIREFINDER mission time, and rear battle accounts for 10%. Maneuver deep battle and covering force account for 5% mission time each.

A typical platoon or section supporting FIREFINDER II will consist of a platoon leader and a platoon sergeant. A section will consist of a system technician, a section chief, and two operator/drivers.

The FFII's operator/drivers (10R10, 13R20X5) will be fully trained in the operation of the system. They must also be able to perform operator/organizational maintenance on the system with the assistance of BIT and TMDE and must be able to drive and maintain the prime mover with its on-board power sources.

The operator/maintainer will conduct organizational maintenance at the section level. Two MSTs will provide intermediate maintenance (DS) in the Headquarters and Light Maintenance Company of the Divisional Maintenance Battalion. The Brigade Maintenance Company of the Support Battalion will provide intermediate maintenance (DS) in Separate Brigades.

At the Corps level, FIREFINDER II radars will be assigned to the Corps TABs and will be allocated to Divisions and Field Artillery Brigades as the mission dictates. Each Corps will contain enough FIREFINDER II radar sections to allocate at least one to each Division. The Corps TAB will provide intermediate maintenance (DS).

* Represents 35% of total weekly operating hours available

SYSTEM PARAMETER 11: MOSs

DISCUSSION

Because the number of MOSs associated with a system affects every HCM step, this number is an important factor in an analysis. The New System's Qualitative and Quantitative Personnel Requirements Information (QQPRI) may list the required MOSs. The Estimator can also identify the number and type of MOSs by listing the crew/operator MOSs and the maintenance MOSs associated with maintenance of the commodity types at each maintenance level. The Estimator should be careful to count all MOSs, including supervisory MOSs, Technical Inspectors, etc., as separate MOSs. He or she must also remember that an HCM analysis is system specific, and that standard-position MOSs may be affected by other systems. Substep 2.1 of HCM Step 2 describes how to determine the New System's MOSs.

PROCEDURES

1. Use the New System documents to identify existing and proposed MOSs that are relevant to the system. List these MOSs in Part 1 of the planning document.

OR

Estimate the New System's MOS requirements by interviewing Program Office personnel or personnel at the proponent schools. Estimates can also be made by studying previously defined parameters.

EXAMPLE

MOSs: FFII requires 18 MOSs.

System-Specific MOSs

- MOS 39CX5 is the primary FFII radar maintainer at both the unit and intermediate levels.
- The System Technician will be a Warrant Officer with a specialty code of 211A, Target Acquisition Radar Technician.
- The section chief will be MOS 13R, Skill Level 3.
- The system operators will be MOS 13R, Skill Levels 1 and 2. The Skill Level 2 operator will receive an ASI: 13R20X5.

Non-System-Specific MOSs

The list below contains the MOSs projected for the FFII radar, including maintenance MOSs associated with all three proposed platforms.

- 29E Communications-Electronics Radio Repairer
- 29N Telephone Central Office Repairer
- 29S Field Communications Security Equipment Repairer
- 31V Tactical Communications Systems Operator/Mechanic
- 35E Special Electronic Devices Repairer
- 39L Field Artillery Digital Systems Repairer
- 44B Metal Worker
- 52C Utilities Equipment Repairer
- 52F Turbine Engine-Driven Generator Repairer
- 63B Light-Wheel Vehicle Mechanic
- 63G Fuel and Electrical Systems Repairer
- 63H Track Vehicle Repairer
- 63J Quartermaster and Chemical Equipment Repairer
- 63T Bradley Fighting Vehicle System Mechanic
- 63W Wheel Vehicle Repairer

SYSTEM PARAMETER 12: UNITS

DISCUSSION

Platforms (e.g., combat vehicles, aircraft) are usually assigned to specific units or type organizations and are commonly identified with those organizations' missions. A component-based system (e.g., a radio) may appear in a variety of units, but in a more supportive role. Substep 2.2 of HCM Step 2 discusses how to determine which units should receive the New System.

PROCEDURES

1. Using fielding plans, O&O plans, and other documents, list in Part 1 of the planning document the units to which the New System will be fielded.

EXAMPLE

Units: FIREFINDER II will be fielded in 26 units:

- Ten Heavy Divisions with four FFII radars per Division
- Eight Light Divisions with four FFII radars per Division
- Three Separate Brigades with one FFII radar per Brigade
- Four Corps with 18 FFII radars at the Corps TAB
- Five radars at Ft. Sill TAB

SYSTEM PARAMETER 13: TRAINING CONCEPT

DISCUSSION

The New System's training concept affects the scope of the HCM Training Resource Requirements Analysis (TRRA). The training analyst documents the training concept in Substep 4.1. The Estimator must develop a high-level training concept that provides the following information:

- a general description of the training concept;
- a list of courses required by the institutional training strategy;
- a description of the unit training strategy; and
- a list and description of the training devices and training equipment.

Optional HCM training analysis procedures are available for estimating requirements for tasks (Substep 4.2), unit training products (Substep 4.9), and training devices/equipment (Substep 4.4). The Estimator must determine whether these additional analyses are required based on the training concept.

PROCEDURES

1. Use the System Training Plan (STRAP) or other New System documents to determine the New System's training concept, institutional training strategy, unit training strategy, and training device/equipment strategy.

OR

If the New System does not have a training concept, estimate this concept after consulting with the proponent New System Training Office (NSTO) or other subject-matter experts.

2. As part of the institutional training strategy, identify the New System's courses of instruction using the NSTO, the Army Training Requirements Resource System (ATTRS), or the Formal Schools Catalog (DA Pam 351-4). Identify the courses of instruction for each MOS identified in System Parameter 11.
3. Record the New System's training concept, institutional training strategy, unit training strategy, and training devices/equipment strategy in Part 1 of the planning document.

EXAMPLE

Training Concept: The Firefinder II is in the Development stage and many questions about the training concept remain unanswered. The US Army Field Artillery School (USAFAS) plans to develop resident institutional training for Skill Level 1 MOS qualification for all FFII operators and organizational maintainers. Exportable training will be developed for sustainment training of operators and organizational maintainers at Skill Levels 2 and 3.

The USAFAS has not yet determined the institutional training (Skill Level 1) for the operators and organizational maintainers for MOS 13R and 17B will be new or modified courses. Skill Level 3 and 4 (Basic and Advanced NCO) courses may also be either modified or new courses.

The USAFAS will develop training for the organizational maintainer. This training will award the soldier an Additional Skill Identifier (ASI) of X5. This course will be offered as institutional training to qualified soldiers in MOS 13R or 26C.

A separate training-device study is planned to determine training-device needs; however, a system to aid collective training in the units is already planned. A training tape that simulated an FFII mission will be developed.

The FFII training concept will also address officer and reserve training. Officer, National Guard, and Army Reserve training, however, is beyond the scope of the HCM.

Institutional Training Strategy: FFII requires 32 courses of instruction. The Target Acquisition Radar Technician Warrant Officer MOS 211 requires course number 4C-211A. The enlisted MOS courses of instruction through Skill Level 3 are as follows:

<u>MOS</u>	<u>Skill Level 1 Course Number</u>	<u>Skill Level 2 Course Number</u>
13R	221-13R10	221-13R30/221-17B30
29E	101-29E10	101-29E30
29N	622-29N10	622-29N30
29S	160-29S10	
31V	101-31V10	101-31V30
35E	198-35E10	
39C	104-39C10	
39L	113-39L10	
44B	704-44B10	
52C	662-52C10	662-52C30
52F	662-52F10	662-52F30
63B	610-63B10	610-63B30
63G	610-63G10	
63H	611-63H10	611-63H30
63J	690-63J10	690-63J30
63T	611-63T10	611-63T30
63W	610-63W10	

Unit Training Strategy: System training support materials, consisting of technical documentation, extension training materials, training literature publications, and other training products to be identified in the Individual and Collective Training Plan will be developed for concurrent testing and fielding with the materiel system. The training packages provided by the materiel developer and the proponent schools (system/MOS) will be used for support of training in units.

Training Device/Equipment Strategy: Any training devices/simulators identified as a result of this ICTP analysis will be developed concurrently and documented in the Required Operational Capability (ROC) for testing and fielding with the FFII. It is expected that a device/simulator for institutional training will be required.

2.3 PART 2: DEVELOPING AN MPT QUESTIONS LIST

Developing a list of MPT questions is the second step in the HCM Planning Document. This list is essential because it focuses the analysis. Without this focus an HCM analysis might provide MPT information that may not be essential to the Army decision-making process, or the analysis may not provide adequate MPT information.

The Estimator must use his or her professional judgment to determine MPT questions that pertain to the New System. The Acquisition Goals and Constraints listed in Part 1, the System MANPRINT Management Plan (SMMP), and the System Training Plan (STRAP) might serve as a starting point for these questions. Table 2.3-1 is an example of an MPT Questions List.

Table 2.3-1. Example of MPT Questions List

1. Will the FIREFINDER II require fewer crew members than the current AN/TPQ-36 and AN/TPQ-37 artillery-locating radars?
2. Will the FIREFINDER II's maintenance manpower requirements be less than the two Predecessor Systems' requirements?
3. Will the envisioned training concept provide soldiers with the skills and knowledge required to repair the system?
4. Will the FIREFINDER II's increase training time?
5. Is the assumption that the FIREFINDER II not require any new MOSs or ASIs correct?
6. The FIREFINDER II is a low-density system (four radars per Division). Will this density provide sufficient workload for the mechanics at Intermediate Forward (DS) and Intermediate Rear (GS)?

2.4 PART 3: DEVELOPING AN HCM ANALYSIS PLAN

The HCM Analysis Plan is the third step in developing the HCM Planning Document. This plan defines the HCM analysis that must be conducted to answer the New System's MPT questions. The Estimator uses this plan to determine the analysis cost in Section 2.5. If funds are not available to support the analysis scope, the Estimator must tailor the analysis scope and reapply the costing procedures.

The HCM Analysis Plan contains two sections. In Section 1 the Estimator revisits the 13 system parameters to assess the extent to which each parameter will be included in the analysis scope. In Section 2 the Estimator determines which of seven additional analysis procedures will be undertaken in the analysis. The Estimator must base his or her decisions on the MPT Questions List from Part 2. The following pages contain the procedures for and examples of Sections 1 and 2.

SECTION 1: SYSTEM PARAMETERS

DISCUSSION

The Estimator uses the system parameters and the MPT Questions List to develop this section. Just as the system description outlined the system scope, Section 1 of the HCM Analysis Plan outlines the scope of the HCM analysis. As he or she develops the HCM Analysis Plan, the Estimator must ensure that the analysis scope addresses the MPT questions from Part 2 of the planning document. If the analysis scope is too narrow, the analysis may not provide complete answers to the MPT questions. A broad analysis scope may result in a costly HCM analysis that provides unnecessary information.

PROCEDURES

1. Obtain Parts 1 and 2 of the HCM Planning Document.
2. Keeping in mind the MPT questions, examine each parameter and decide the extent to which it will be included in the HCM analysis.

EXAMPLE

Section 1: System Parameters

1. **Materiel Commodities**
The FFII HCM analysis will include 13 of the 14 materiel commodities, excluding Test Equipment.
2. **Maintenance Concept**
The FFII HCM analysis will include two maintenance levels: Intermediate Forward and Intermediate Rear. Depot maintenance requirements will not be included in the analysis.
3. **Acquisition Strategy**
The FFII's acquisition strategy is a block approach Product Improvement Program (PIP) that will result in a single system to replace the two existing radars. The FFII HCM analysis will include improved radar (Block III) and improved mobility (Block IV).
4. **Acquisition Milestones**
The acquisition milestones do not affect the FFII HCM analysis.
5. **System Boundary**
The FFII HCM analysis will be conducted at the force structure boundary.
6. **Missions**
The FFII's primary mission is "Locate and provide critical information on potential targets."

7. Acquisition Goals and Constraints

The acquisition goals and constraints listed in Part 1 will be considered in the FFII HCM analysis.

8. Alternative Platforms and Proposed Systems

The platforms to be considered in the FFII HCM analysis are the five-ton truck and the trailing arm drive vehicle. The Multiple Launch Rocket System (MLRS) chassis will not be included in the analysis.

9. Equipment

Thirty generic equipment components will be included in the FFII HCM analysis. (Built-in test equipment will be excluded.)

10. Operational Concept (Usage Rates)

The FFII's operational concept and all six usage rates listed in Part 1 will be used in the FFII HCM analysis.

11. MOSs

Fourteen MOSs will be included in the FFII HCM analysis. Warrant Officers and MLRS MOSs will not be included in the analysis. The HCM analysis will include MOS 39CX5, 13R, 29E, 29S, 31V, 39L, 35E, 44B, 52C, 52F, 63B, 63G, 63J, and 63W.

12. Units

All 26 of the FFII units will be included in the HCM analysis.

13. Training Concept

Nineteen courses of instruction will be included in the FFII HCM analysis. The Army has not finalized the training concept. The HCM analysis will use the Predecessor System's training concept.

Warrant Officer, MLRS, non-system-specific courses beyond Skill Level 1, and National Guard/Army Reserve training will not be included in the analysis.

SECTION 2: ADDITIONAL ANALYSIS PROCEDURES

DISCUSSION

Once the Estimator has defined the basic analysis in Section 1, he or she must decide whether the analysis should include any of the eight additional procedures described below. The Estimator should include these procedures only if they will answer an MPT question. These procedures will increase the time and cost of the analysis.

1. Predecessor System Definition and Analysis

The HCM provides multiple methods to determine Predecessor System manpower requirements. Manpower can be determined using requirements documents such as the TOE (i.e., the soldiers that support the Predecessor System) or performing an analysis of the Predecessor System's manpower requirements based on reliability and maintainability (R&M) data.

The first method simply identifies the Predecessor System's requirements "footprint." The footprint provides an estimate of the soldiers available to support the New System.

The second method determines the actual number of soldiers required to support the Predecessor System based on historical R&M data. This method provides a comparison of the New System's manpower requirements with the Predecessor System's requirements.

2. Combat Damage Assessment

The HCM analysts can determine combat damage workload only when combat damage maintenance data are available. The Estimator should be certain that these data exist before he or she includes combat damage assessment in the HCM analysis.

3. Reserve Manpower Requirements

The HCM provides procedures for the determination of active Army, Reserve, and National Guard manpower requirements. Usually, only Active Army requirements are determined.

4. Deployment/Retirement Manpower Requirements

The HCM provides procedures to determine manpower requirements during the retirement of the Predecessor System and the deployment of the New System. Typically, requirements are determined based on the steady-state, fully fielded New System densities.

5. Task Comparability Analysis

Substep 4.2 provides procedures for determining training task requirements. Comparable tasks, from which New System tasks are generated, allow the training analyst to estimate skill and knowledge requirements, training products, training settings, course requirements, aptitude requirements, etc. Task comparability analysis is time consuming and is typically performed later in the acquisition process when system design is more set.

6. Unit Training Product Requirements

Substep 4.9 provides procedures to estimate unit training product requirements. Unit training products such as Army Correspondence Course Programs (ACCPs), Army Training and Evaluation Programs (ARTEPs), skill qualification tests (SQTs), and technical manuals (TMs) are expensive to develop, maintain, and disseminate. Task Comparability Analysis must be included in the analysis in order to conduct unit training product estimation. Unit training product analysis is time consuming and should be performed later in the acquisition process.

7. Aptitude and Mental Category Requirements

In Substep 4.3 the HCM provides a tool that uses comparability analysis to make initial estimates of the New System's soldier aptitude and mental category requirements. In Step 5. Impact Analysis, the HCM analysts assess whether the available personnel pool can satisfy these aptitude and mental category requirements.

8. Course Material Requirements

Substep 4.4 provides procedures for determining course material requirements including training devices/equipment and their associated facilities, ammunition, and fuel requirements. These procedures are time consuming and require extensive data collection; they should be performed only if there is an MPT question concerning training devices/equipment.

PROCEDURES

1. Determine whether any of the additional analysis procedures should be included in the analysis. Document these decisions in the HCM Analysis Plan.

EXAMPLE

Section 2: Additional Analysis Procedures

1. Predecessor System Definition and Analysis

The FFII's manpower analysis will include analysis of current requirements (foot-print) and determination of manpower requirements using historical R&M data.

2. Combat Damage Assessment

The FFII analysis will not address combat damage manpower requirements because combat damage data are not available for target-acquisition systems.

3. Reserve Manpower Requirements

Manpower requirements will be determined for the Active Army only. The Reserve and National Guard requirements will not be determined.

4. Deployment/Retirement Manpower Requirements

Deployment/Retirement manpower requirements will be determined for 16 time intervals.

5. Task Comparability Analysis

Task comparability analysis will not be performed in the analysis.

6. Unit Training Product Requirements

Unit training product requirements will not be determined in the analysis.

7. Aptitude and Mental Category Requirements

Aptitude and mental category requirements will not be determined in the analysis.

8. Course Material Requirements

Course material requirements will not be determined in the analysis.

2.5 PART 4: ESTIMATING THE COST OF AN HCM ANALYSIS

Estimating the cost of the analysis (as it is defined in the Analysis Plan) is the next step in the analysis-planning process. This subsection presents 12 procedures the Estimator will use to estimate the time and cost of an HCM analysis. The 12 HCM cost-estimation procedures are:

- (1) Estimate Base-Analysis Time
- (2) Adjust Time for Analysis of System Alternatives
- (3) Add Data Collection and Analysis Time
- (4) Add Analyst Skill Level Time
- (5) Add Management Time
- (6) Add Travel Time
- (7) Add Production Time
- (8) Convert Time Estimate to Cost Estimate
- (9) Determine Final Cost
- (10) Adjust the Cost for Use of MIST (Optional)
- (11) Estimate the Cost of Impact Analysis
- (12) Estimate the Cost of Tradeoff Analysis

In Procedure 1, the Estimator develops a time estimate for a base HCM analysis that includes Systems Analysis, Manpower Requirements Analysis, Personnel Pipeline Analysis, and Training Resource Requirements Analysis. Procedure 2 enables the Estimator to determine how much time is required to analyze additional system alternatives.

In Procedures 3, 4, 5, 6, and 7, the Estimator adjusts the time estimate for data collection and analysis, analyst skill level, production, management, and travel time. In Procedure 8 the Estimator converts the time estimate to a cost estimate, and in Procedure 9, the Estimator determines the final cost of the analysis. Procedure 10 is optional. The Estimator may use this procedure to adjust the final cost to include the Man Integrated Systems Technology (MIST) software. The Estimator uses Procedures 11 and 12 to determine the cost of Impact Analysis and Tradeoff Analysis.

Throughout this section, the Estimator uses a series of worksheets to document the time and cost estimates. Blank copies of these worksheets are provided at the back of this volume.

PROCEDURE 1 - ESTIMATE BASE-ANALYSIS TIME

DISCUSSION

In this procedure the Estimator develops a man-month estimate for a base HCM analysis of the New System.

SUBPROCEDURES

Using Worksheet 1:

1. List in column B the quantities for each parameter in column A. The quantity of each parameter can be obtained from the HCM Analysis Plan.
2. Multiply the quantities in column B by the multipliers in column C and record the product in column D. Repeat the process, multiplying column B by column E, column B by column G, and column B by column I.
3. Total the figures in columns D, F, H, and J.
4. Convert man-days to man-months by dividing the totals by 20, and record the man-months at the bottom of each column.
5. Add the man-months in columns D, F, H, and J and record the total in column K.

Table 2.5-1 is an example of Worksheet 1.

Table 2.5-1. Example of Worksheet 1

WORKSHEET 1: Base-Analysis Time Estimation

NEW SYSTEM		SYSTEMS ANALYSIS		MANPOWER ANALYSIS		PERSONNEL ANALYSIS		TRAINING ANALYSIS		Base Analysis Time
Analysis Parameter	Quantity	Man-Day Multiplier	Analysis Time	Man-Day Multiplier	Analysis Time	Man-Day Multiplier	Analysis Time	Man-Day Multiplier	Analysis Time	
A	B	C	D	E	F	G	H	I	J	K
New System										
Missions	1	1 per 1	1	3 per 1	3					
Commodities	13	2 per 1	26							
Equipment	30	.5 per 1	15							
Usage Rates	6	2 per 1	12	1 per 1	6					
Maintenance Levels	2	6 per 1	12	5 per 1	10					
MOSs	14	2 per 1	28	1 per 1	14	1 per 1	14	4 per 1	84	
Courses	21									
Units	26									
OPTIONAL										
R&M Predecessor										
Equipment	42	.5 per 1	21	1st unit 10 days all units (including 1st) .5 day additional	10 + 13=23					
Combat Damage	N/A			1 per 1						
MOSs	N/A									
Reserve/NG Manpower	N/A			1 per 1						
Units										
Deployment/Retirement										
Fielding Intervals	16									
Task Comparability	N/A			.5 per 1	8					
MOS	N/A							40 per 1		
Unit Training Products	N/A							20 per 1		
MOS	N/A							.5 per 1		
Aptitude	N/A							30 per 1		
Modified/New POIs										
Course Materials	N/A									
POIs										
Total Man-Days			115		64		14		84	
Total Man-Months (divide by 20)			5.75		3.2		0.7		4.2	13.85

PROCEDURE 2 - ADJUST TIME FOR ANALYSIS OF SYSTEM ALTERNATIVES

DISCUSSION

In this procedure the Estimator adjusts the base-analysis estimate to account for the analysis of system alternatives. This procedure enables the Estimator to answer the question, "What will it cost to examine all system variants?"

A base HCM analysis examines the Predecessor System's R&M-based manpower requirements and one BCS. The Estimator must consider an important factor concerning the Predecessor System: lack of a Predecessor System analysis increases the analysis time by .3 (30%). This increased workload is due to the increased data collection and analysis caused by not having a Predecessor System as an analytic starting point in each HCM step.

SUBPROCEDURES

Using Worksheet 2:

1. Enter in columns B and E the base-analysis time from Worksheet 1.
2. Determine the adjustment factor for each BCS and Proposed System alternative and enter these adjustment factors in columns C and F.
3. Multiply column B by column C and record the product in column D. Multiply column E by column F and record the product in column G.

Table 2.5-2 is an example of Worksheet 2.

Using Worksheet 3:

1. Enter in column B the base-analysis time from Worksheet 1.
2. Enter in column C the additional analysis times from Worksheet 2, columns D and G.
3. Add the analysis time in column B to the additional times in column C and record the sum in column D.

Table 2.5-3 is an example of Worksheet 3.

Table 2.5-2. Example of Worksheet 2

WORKSHEET 2: Alternative Systems Adjustment Factors

	(LESS)			Analysis Complexity			(MORE)	
	BCS Alternative #1	BCS Alternative #2	BCS Alternative #3	Proposed System Alternative #1	Proposed System Alternative #2	Proposed System Alternative #3		
Lack of Predecessor System								
.3	Included in Base-Analysis Time	.1	.05*	.1	.05	.05		

* (NOTE: The adjustment factor for two BCS alternatives would be $.1 + .05 = .15$ (15%), and the adjustment factor for three Proposed System alternatives would be $.1 + .05 + .05 = .2$ (20%).)

A	B	C	D	E	F	G
HCM STEP	Base-Analysis Time (Worksheet 1, Cols. D, F, H, J)	BCS Adjustment Factor	Multiple BCS Analysis Time	Base-Analysis Time (Worksheet 1, Cols. D, F, H, J)	Proposed System Adjustment Factor	Proposed System Analysis Time
Systems Analysis	5.75 x	.15 =	0.86	5.75 x	.2 =	1.15
Manpower	3.20 x	.15 =	0.48	3.20 x	.2 =	0.64
Personnel	0.70 x	.15 =	0.11	0.70 x	.2 =	0.14
Training	4.2 x	.15 =	0.63	4.2 x	.2 =	0.84

Table 2.5-3. Example of Worksheet 3

WORKSHEET 3: Summary Table

A	B	C	D
HCM Step	Base-Analysis Time (Worksheet 1, Cols. D,F,H,J)	System Alternatives (Worksheet 2, Cols. D & G)	Adjusted Base- Analysis Time
Systems Analysis	5.75	+ 0.86 + 1.15 =	7.76
Manpower Analysis	3.20	+ 0.48 + 0.64 =	4.32
Personnel Analysis	0.70	+ 0.11 + 0.14 =	0.95
Training Analysis	4.20	+ 0.63 + 0.84 =	5.67
Total Man-Months			18.70

PROCEDURE 3 - ADD DATA COLLECTION AND ANALYSIS TIME

DISCUSSION

In this procedure the Estimator adjusts the base-analysis time to account for data collection and analysis. The Estimator uses Worksheets 4, 5, 6, and 7 to determine the data collection and analysis time for HCM Steps 1 through 4. On Worksheet 8, the Estimator summarizes the data collection and analysis time and adds it to the base-analysis time.

Without detailed information about the analysis parameters, the Estimator may find it difficult to distribute the analysis time for the following subprocedures. The Estimator may choose to use an average or assumed data collection factor and apply it to the total analysis time for each of the HCM steps. This approach provides a usable but less accurate time estimate.

SUBPROCEDURES

Using Worksheet 4:

1. Estimate the analysis time required for systems analysis of major subsystems. Enter these time estimates (in man-months) in column A.
2. Enter in column B the appropriate data collection and analysis time factor for each of the major subsystems.
3. Multiply column A by column B and record the product in column C.
4. Total the data collection and analysis time at the bottom of column C.

Table 2.5-4 is an example of Worksheet 4.

Using Worksheet 5:

1. Enter in column A the number of each MOS type for the Manpower Requirements Analysis step and multiply by the number of days (at 1 day per MOS).
2. Enter in column A the number of days each optional HCM procedure requires.
3. Enter in column B the appropriate data collection and analysis factors for the MOS types and optional procedures.
4. Multiply column A by column B and record the product in column C.
5. Total the man-days at the bottom of column C.
6. Convert man-days to man-months and record the result at the bottom of column C.

Table 2.5-5 is an example of Worksheet 5.

Table 2.5-4. Example of Worksheet 4

WORKSHEET 4: Systems Analysis Data Collection and Analysis Adjustment Factors

← (Less)		Analysis Complexity			(More) →
Fielded Equipment with MARC Data	Fielded Equipment with SDC Data	Fielded Equipment with Navy 3M or USAF 66-1 Data	Contractor-Supplied RAM Data	NDI System	• New Technology • Depot Level Maintenance
.1	.2	.4	.5	.6	.7

A		B		C	
Systems Analysis Detailed Base-Analysis Time		Adjustment Factor		Systems Analysis Data Collection and Analysis Time	
Electronics (Radar)	2.5	x	.4	=	1.0
Electronics (Comm.)	1	x	.2	=	0.2
Mechanical (Platform)	2.5	x	.2	=	0.5
Environmental & Power	1	x	.1	=	0.1
Other	0.76	x	0	=	0
	<u>7.76</u>				
				Total Man-Months	1.8

Table 2.5-5. Example of Worksheet 5

**WORKSHEET 5: Manpower Data Collection and Analysis
Adjustment Factors**

← (Less)	Analysis Complexity			(More) →
Type 1 MOS	Type 2 MOS	Type 3 MOS	Type 4 MOS	
Current MOS in AR611-201	Supervisors and Technical Inspectors (Additional Skill Levels)	Consolidation of Two or More Current MOSs in AR611-201	New MOS	
.1	.2	.25	.3	

Factors for Optional HCM Procedures

.2 for Combat Damage Analysis Time

.1 for Reserve/NG Analysis Time

.1 for Deployment/Retirement Analysis Time

A		B		C
Manpower Analysis Detailed Base Analysis Time		Adjustment Factor		Manpower Analysis Data Collection and Analysis Time
(1 Type 3)	1 Day	x .25	=	0.25
(2 Type 2)	2 Days	x .2	=	0.4
(11 Type 1)	11 Days	x .1	=	1.1
Combat Damage Analysis Time	0 Days	x .2	=	0
Reserve/NG Analysis Time	0 Days	x .1	=	0
Deployment/Retirement Analysis Time	8 Days	x .1	=	0.8
Total Man-Days				2.55
Total Man-Months				0.13

Using Worksheet 6:

1. Enter in column A the number of each MOS type for the Personnel Pipeline Analysis step. Also, enter the number of days (at 1 day per MOS).
2. Enter in column B the appropriate data collection and analysis factors for the MOS types.
3. Multiply column A by column B and record the product in column C.
4. Total the man-days at the bottom of column C.
5. Convert man-days to man-months and record the result at the bottom of column C.

Table 2.5-6 is an example of Worksheet 6.

Using Worksheet 7:

1. Enter in column A the number of each course type for the Training Resource Requirements Analysis step and multiply this number by the number of days (at 6 days per course).
2. Enter in column A the number of days each optional HCM procedure requires.
3. Enter in column B the appropriate data collection and analysis factors for the course types and optional procedures.
4. Multiply column A by column B and record the product in column C.
5. Total the man-days at the bottom of column C.
6. Convert man-days to man-months and record the result at the bottom of column C.

Table 2.3-7 is an example of Worksheet 7.

Using Worksheet 8:

1. Enter in column B the base-analysis time from Worksheet 3.
2. Enter in column C the data collection and analysis time in man-months for each HCM step.
3. Add columns B and C and record each sum in column D.
4. Total the adjusted base-analysis time at the bottom of column D.

Table 2.5-8 is an example of Worksheet 8.

Table 2.5-6. Example of Worksheet 6

**WORKSHEET 6: Personnel Data Collection and Analysis
Adjustment Factors**

Type 1 MOS Current MOS Attrition/Promotion/Migration/ TTHS Data Available	Type 2, 3, or 4 MOS Consolidation or Development of Comparable Rate Data
.1	.2

A	B	C
Personnel Analysis Detailed Base- Analysis Time	Adjustment Factor	Personnel Analysis Data Collection and Analysis Time
(11 Type 1 MOSS) 11 days x	.1 =	1.1
(2 Type 2 MOSS) 2 days x	.2 =	0.4
(1 Type 3 MOSS) 1 day x	.2 =	0.2
Total Man-Days		1.7
Total Man-Months		0.09

Table 2.5-7. Example of Worksheet 7

WORKSHEET 7: Training Data Collection and Analysis Adjustment Factors

Analysis Complexity (More)→					Factors for Optional HCM Procedures
Type 1 Course Current Approved Course POI	Type 2 Course Established Course POI Not Approved or no TRADOC Form 377-R* Available	Type 3 Course Consolidation of Two Current Army Courses	Type 4 Course Consolidation of Two or More Courses Including Use of USAF or Navy POI	Type 5 Course Development of Entirely New Quasi-POI	.5 for Unit Training Analysis Time .5 for Training Concept Analysis Time .05 for Aptitude and Mental Category
.1	.2	.3	.5 - .6	.7 - .8	

*TRADOC Form 377-R contains Instructor Contact Hours (ICH) and is necessary for HCM Training Analysis.

A		B		C	
Training Analysis Detailed Base-Analysis Time		Adjustment Factor		Training Analysis Data Collection and Analysis Time	
(13 Type 1 Courses)	78 days	x	.1	=	7.8
(1 Type 3 Course)	6 days	x	.3	=	1.8
Unit Training Analysis Time	0 days	x	.5	=	0
Training Concept Analysis Time	0 days	x	.5	=	0
Aptitude Analysis Time	0 days	x	.05	=	0
Total Man-Days					9.6
Total Man-Months					0.48

Table 2.5-8. Example of Worksheet 8

WORKSHEET 8: Summary Table

A	B	C	D
HCM Step	Adjusted Base-Analysis Time (Worksheet 3, Col. D)	Data Collection and Analysis Time (Worksheets 4-7, Col. C)	Adjusted Base- Analysis Time
Systems Analysis	7.76	+ 1.8	= 9.56
Manpower Analysis	4.32	+ 0.13	= 4.45
Personnel Analysis	0.95	+ 0.09	= 1.04
Training Analysis	5.67	+ 0.48	= 6.15
Total Man-Months			21.20

PROCEDURE 4 - ADD ANALYST SKILL LEVEL TIME

DISCUSSION

In this procedure the Estimator adjusts the base-analysis time to account for the HCM analysts' skill levels. The Estimator must make this adjustment by HCM step because the analysts will vary in experience.

SUBPROCEDURES

Using Worksheet 9:

1. Determine each analyst's skill level and record it in column B.
2. Enter in column C the adjusted base-analysis time from Worksheet 8.
3. Enter in column D the appropriate adjustment factor for each skill level in column B.
4. Multiply column C by column D and record the product in column E.

Table 2.5-9 is an example of Worksheet 9.

Using Worksheet 10:

1. Enter in column B the adjusted base-analysis time from Worksheet 8.
2. Enter in column C the skill level time for each HCM step.
3. Add columns B and C for each HCM step and record each sum in column D.
4. Total the adjusted base-analysis time at the bottom of column D.

Table 2.5-10 is an example of Worksheet 10.

Table 2.5-9. Example of Worksheet 9

WORKSHEET 9: Analyst Skill Level Adjustment Factors

Analyst Skill Level	NOVICE	INTERMEDIATE	ADVANCED	INTERMEDIATE	EXPERT
	No HCM Experience	1-2 HCM Applications	2-5 HCM Applications	5 or More HCM Applications	
Factor	+ .5	+ .2	0	- .2	

A	B	C	D	E
HCM Step	Analyst Skill Level	Adjusted Base-Analysis Time (Worksheet 8, Col. D)	Adjustment Factor	Skill Level Time
Systems Analysis	Expert	9.56	x -.2	= -1.91
Manpower Analysis	Advanced Int.	4.45	x 0	= 0
Personnel Analysis	Intermediate	1.04	x +.2	= 0.21
Training Analysis	Intermediate	6.15	x +.2	= 1.23

Table 2.5-10. Example of Worksheet 10

WORKSHEET 10: Summary Table

A	B	C	D
HCM Step	Adjusted Base- Analysis Time (Worksheet 8, Col. D)	Skill Level Time (Worksheet 9, Col. E)	Adjusted Base- Analysis Time
Systems Analysis	9.56	+ -1.91	= 7.65
Manpower Analysis	4.45	+ 0	= 4.45
Personnel Analysis	1.04	+ 0.21	= 1.25
Training Analysis	6.15	+ 1.23	= 7.38
Total Man-Months			20.73

PROCEDURE 5 - ADD MANAGEMENT TIME

DISCUSSION

In this procedure the Estimator adds management time to the base-analysis time. HCM analyses rarely require a full-time manager. The HCM analysis manager should be an analyst who has worked on two or more HCM analyses and understands the entire methodology.

The HCM manager's job is to interact with MPT information users to establish basic analysis assumptions, the schedule, meetings, and deliverables. The HCM manager must also coordinate the analysis team's progress. (Section 3 discusses this role and its responsibilities.)

The Estimator should consider the following assumptions before calculating the manager's time:

- the scope and complexity of an HCM analysis is directly related to its size (in man-months); and
- the need for coordination with users and within the HCM analysis team is directly related to the size (in man-months) of the analysis.

The HCM analysis manager's time should not be more than 20% of the total man-month requirements.

SUBPROCEDURES

Using Worksheet 11:

1. Enter in column A the adjusted base-analysis time total from Worksheet 10.
2. Multiply column A by column B and record the product in column C.
3. Enter in column E the adjusted base-analysis time for each HCM step from Worksheet 10 and the management time.
4. Total the adjusted base-analysis time at the bottom of column E.

Table 2.5-11 is an example of Worksheet 11.

Table 2.5-11. Example of Worksheet 11

WORKSHEET 11: Management Adjustment Factor				
A	B	C	D	E
Adjusted Base-Analysis Time Total (Worksheet 10, Col. D)	Adjustment Factor	Management Time	HCM Step	Adjusted Base-Analysis Time
20.73	x	.2	=	4.15
			Systems Analysis	= 7.65
			Manpower Analysis	= 4.45
			Personnel Analysis	= 1.25
			Training Analysis	= 7.38
			Management	= 4.15
			Total Man-Months	24.88

PROCEDURE 6 - ADD TRAVEL TIME

DISCUSSION

In this procedure the Estimator adds travel time to the adjusted base-analysis time. Table 2.5-12 lists typical meeting and travel requirements for an HCM analysis. The travel time is typical for an analysis team based on either the East or West Coast and an HCM Technical Advisory Group (TAG) that conducts its meetings in the middle of the country (e.g., Ft. Sill, Oklahoma). Additional travel time for data collection may also be required.

SUBPROCEDURES

Using Worksheet 12:

1. Enter in column C the meeting time (in days) required for each meeting listed in column B.
2. Enter in column D the travel days required for each meeting.
3. Add columns C and D and record the sum in column E.
4. Enter in column F the number of people attending each meeting.
5. Multiply column E by column F and record the product in column G.
6. Using the information from columns F and G, distribute the travel by HCM step in column I.
7. Convert man-days to man-months in column J.

Table 2.5-12 is an example of Worksheet 12.

Using Worksheet 13:

1. Enter in column B the adjusted base-analysis time for each HCM step from Worksheet 11.
2. Enter the travel time for each HCM step in column C.
3. Add columns B and C and record the sum in column D.
4. Enter in column D the management time from Worksheet 11.
5. Total the adjusted base-analysis times at the bottom of column D.

Table 2.5-13 is an example of Worksheet 13.

Table 2.5-12. Example of Worksheet 12

WORKSHEET 12: Travel Requirements

A	B	C	D	E	F	G
Trip Number	Meeting Name	Meeting Time In Days	Travel Time In Days	Total Days	No. of People	Man-Days Total
1	Project Planning Meeting	1	2	3	1 (Manager)	3
2	In Process Review (IPR) 1	1	2	3	2 (Manager, Engineer)	6
3	Training Data Collection	1	2	3	1 (Training Analyst)	3
4	In Process Review (IPR) 2	1	2	3	4 (Manager, Engineer, M/P Analyst, Training Analyst)	12
5	Final Results Briefing	1	2	3	3 (Manager, M/P Analyst, Training Analyst)	9

Distribution of Travel Time by HCM Step

H	I	J
HCM Step	Man-Days	Man-Months
Systems Analysis	12	.6
Manpower Analysis	8	.4
Personnel Analysis	0	0
Training Analysis	10	.5

Table 2.5-13. Example of Worksheet 13

WORKSHEET 13: Summary Table

A	B	C	D
HCM Step	Adjusted Base- Analysis Time (Worksheet 11, Col. E)	Travel Time (Worksheet 12, Col. J)	Adjusted Base- Analysis Time
Systems Analysis	7.65	+	8.25
Manpower Analysis	4.45	+	4.85
Personnel Analysis	1.25	+	1.25
Training Analysis	7.38	+	7.88
Management	N/A	N/A	4.15
Total Man-Months			26.38

PROCEDURE 7 - ADD PRODUCTION TIME

DISCUSSION

In this procedure the Estimator adjusts the base-analysis time for labor costs associated with producing analysis results. HCM analysis results are usually produced as reports and as overhead transparencies. Worksheet 14 presents adjustment factors for preparing various presentations and reports. The analysis scope affects the time required to write reports.

SUBPROCEDURES

Using Worksheet 14:

1. Enter in column B the adjusted base-analysis time from Worksheet 13.
2. Enter the appropriate adjustment factor in column C (same factor for all steps).
3. Multiply column B by column C and record the product in column D.

Table 2.5-14 is an example of Worksheet 14.

Using Worksheet 15:

1. Enter in column B the adjusted base-analysis time from Worksheet 13.
2. Enter the production time by step in column C.
3. Add columns B and C and record the sum in column D.
4. Enter in column D the management time from Worksheet 11.
5. Total the analysis times at the bottom of column D.

Table 2.5-15 is an example of Worksheet 15.

Table 2.5-14. Example of Worksheet 14

WORKSHEET 14: Production Adjustment Factors

← (Less)		Analysis Complexity	(More) →
Missions	1 - 3	3 - 5	5 or more
Maintenance Levels	Crew/Org I Forward I Rear	Crew/Org I Forward I Rear	Crew/Org I Forward I Rear
MOS	1 - 5	5 - 10	10 - 20
Equipment	1 - 100	100 - 200	200 - 500
Report and Presentation Preparation Factor	.04	.06	.08

A	B	C	D
HCM Step	Adjusted Base-Analysis Time (Worksheet 13, Col. D)	Adjustment Factor	Production Time
Systems Analysis	8.25	x .06	= 0.50
Manpower Analysis	4.85	x .06	= 0.30
Personnel Analysis	1.25	x .06	= 0.08
Training Analysis	7.88	x .06	= 0.47

Table 2.5-15. Example of Worksheet 15

WORKSHEET 15: Summary Table			
A	B	C	D
HCM Step	Adjusted Base- Analysis Time (Worksheet 13, Col. D)	Production Time (Worksheet 14, Col. D)	Total Analysis Time
Systems Analysis	8.25	+	8.75
Manpower Analysis	4.85	+	5.15
Personnel Analysis	1.25	+	1.33
Training Analysis	7.88	+	8.35
Management	N/A	N/A	4.15
Total Man-Months			27.73

PROCEDURE 8 - CONVERT TIME ESTIMATE TO COST ESTIMATE

DISCUSSION

In this procedure the Estimator converts the analysis time to a dollar cost.

SUBPROCEDURES

Using Worksheet 16:

1. Enter in column B the total analysis time for each HCM step from Worksheet 15 and the management time from Worksheet 11.
2. List the analyst skill level for each step in column C.
3. Enter the monthly salary in column D.
4. Multiply column B by column D and record the product in column E.
5. Total the costs at the bottom of column E.

Table 2.5-16 is an example of Worksheet 16.

Table 2.5-16. Example of Worksheet 16

ANALYST LEVEL	MONTHLY SALARY RANGE	ANALYST LEVEL	MONTHLY SALARY RANGE	ANALYST LEVEL	MONTHLY SALARY RANGE	ANALYST LEVEL	MONTHLY SALARY RANGE
Analyst/Engineer Level 1	\$2,000-\$2,500	Analyst/Engineer Level 2, 2-3 Years of HCM Experience	\$2,500-\$3,000	Analyst/Engineer Level 3-4, 3-5 Years of HCM Experience	\$3,000-\$3,400	Analyst/Engineer Level 4-5, 5-10 Years of HCM Experience	\$3,400-\$4,200

WORKSHEET 16: Direct Labor Calculation

A	B	C	D	E
HCM Step	Total Analysis Time (Worksheet 15, Col. D)	Analyst Skill Level (Worksheet 9, Col. B)	Monthly Salary	Total Direct Labor Costs
Systems Analysis	8.75	Expert	\$3,500	\$30,625
Manpower Analysis	5.15	Advanced Intermediate	\$3,000	\$15,450
Personnel Analysis	1.33	Intermediate	\$2,200	\$2,926
Training Analysis	8.35	Intermediate	\$2,200	\$18,370
Management	4.15	Expert	\$4,000	\$16,600
			Total	\$83,971

PROCEDURE 9 - DETERMINE THE FINAL COST

DISCUSSION

In this procedure the Estimator calculates the final cost of an analysis completed by a contractor. These costs usually include a company's overhead, Other Direct Costs (ODCs), general and administrative, and fee. (These costs vary depending on the type of contract.) One formula for determining the final cost of a contractor project is:

$$\text{DIRECT LABOR} + \text{OVERHEAD} + \text{ODCs} + \text{G\&A} + \text{FEE} = \text{TOTAL COST}$$

The overhead, G&A, and fee are fixed rates, and the Estimator must determine the ODCs. The Estimator uses Worksheet 17 to calculate contractor travel costs and Worksheet 18 to apply the formula above.

SUBPROCEDURES

Using Worksheet 17:

1. Enter in column C the meeting times from Worksheet 12.
2. Enter the meeting locations in column D.
3. Enter in column E the total travel days and number of people from Worksheet 12.
4. Enter costs for hotel (column F), subsistence, (column G), parking (column H), rental car (column I), mileage (column J), and air fare (column K) as required.
5. Total columns F, G, H, I, J, and K.

Table 2.5-17 is an example of Worksheet 17.

Using Worksheet 18:

1. Enter in column A the total direct-labor cost from Worksheet 16.
2. Multiply column A by the overhead rate. Add this product to the direct labor and record the sum in column B.
3. Add column B and the other direct costs and record the sum in column C.
4. Multiply column C by the G&A rate. Add this product to the number in column C and record this sum in column D.
5. Multiply column D by the fee rate. Add this product to the number in column D and record this sum in column E. Column E is the final cost of the HCM analysis.

Table 2.5-17. Example of Worksheet 17

WORKSHEET 17: Contractor Travel Costs

A Trip Number (Worksheet 12, Col. A)	B Meeting Name (Worksheet 12, Col. B)	C Meeting Time in Days (Worksheet 12, Col. C)	D Destination	E		F Hotel Cost
				Total Days (Worksheet 12, Col. E)	No. of People (Worksheet 12, Col. F)	
1	Project Planning Meeting	1	Ft. Sill, Oklahoma	3	1	2 nights @ \$35 per night x 1 room = \$70
2	In Process Review (IPR) 1	1	Ft. Sill, Oklahoma	3	2	1 night @ \$35 per night x 2 rooms = \$70
3	Data Collection	1	Signal Center and School, Georgia	3	1	1 night @ \$45 per night x 1 room = \$45
4	In Process Review (IPR) 2	1	Ft. Sill, Oklahoma	3	4	1 night @ \$35 per night x 4 rooms = \$140
5	Final Results Briefing	1	Ft. Sill, Oklahoma	3	3	2 nights @ \$35 per night x 3 rooms = \$210
Column F Subtotal						\$535

Note: This example assumes an HCM team based on the East Coast or West Coast traveling to the destinations listed.

Table 2.5-17. Example of Worksheet 17 (Continued)

WORKSHEET 17: Contractor Travel Costs

G	H	I	J	K
Subistence Cost, Contractor	Airport Parking	Rental Car	Personal Car Mileage Cost No. of Cars	Airfare
3 days @ \$25 per day = \$75	3 days @ \$10 per day = \$30	1 car @ \$40 per day x 1 day = \$40	\$20 1	\$ 550
3 days @ 25 per day x 3 people = \$225	3 days @ \$10 per day x 3 people = \$90	1 car @ \$40 per day x 2 days = \$80	\$60 3	\$1,650
3 days @ \$25 per day = \$75	3 days @ \$10 per day = \$30	1 car @ \$40 per day x 2 days = \$80	\$20 1	\$ 550
3 days @ \$25 per day x 3 people = \$225	3 days @ \$10 per day x 3 people = \$90	1 car @ \$40 per day x 2 days = \$80	\$60 3	\$1,650
3 days @ \$25 per day x 3 people = \$225	3 days @ \$10 per day = \$30	1 car @ \$40 per day x 2 days = \$80	\$60 3	\$1,650
Column G Subtotal: \$825	Column H Subtotal: \$270	Column I Subtotal: \$360	Column J Subtotal: \$220	Column K Subtotal: \$6,050

Total Travel Cost: \$8,260

Table 2.5-18 shows the calculation of other contractor costs for Corporation X. Corporation X is a hypothetical contractor with an overhead rate of 100 percent, a general and administrative rate of 10 percent, and a fee of 10 percent.

Corporation X has other expenses in addition to the HCM analysts' salaries. These expenses include building rental, heat and lights, secretaries and other support workers, employee medical coverage, pension plans, etc. Corporation X's overhead costs are 100 percent of an analyst's salary. Therefore, an analyst who earns \$2,500 per month is billed at \$5,000 per month.

Corporation X also has a general and administrative rate of 10 percent. The G&A cost includes corporate officers and accounting and payroll personnel. Finally, Corporation X is allowed to charge a fee (profit) for its services. The fee in this example was negotiated at 10 percent.

Table 2.5-18. Example of Worksheet 18

WORKSHEET 18: Determine Final Costs

A	B	C	D	E
Total Direct Labor Costs (Worksheet 16, Col. E)	Direct Labor Plus Overhead (Burdened Labor)	Burdened Labor Plus ODCs	Addition of G&A	Addition of Fee
\$83,971	\$167,942	\$181,452	\$199,597	\$219,556

Computation of Corporation X Job Cost

* Other Direct Costs

Travel	8,260
Material	250
Computer	5,000
Total ODC	\$13,510

Total Labor 83,971
Overhead 100% (1.00) 1.00
83,971

Labor & Overhead 83,971
83,971
167,942

*Other Direct Costs (ODCs) 167,942
13,510
181,452

General & Administrative 181,452
18,145
199,597

Fee (10%) 199,597
19,959
219,556

PROCEDURE 10 - ADJUST THE COST FOR THE USE OF MIST (OPTIONAL)

DISCUSSION

The HCM is a manual process; however, the Army has an automated tool for performing HCM analyses: the Man Integrated Systems Technology (MIST). MIST was developed for and is available from the U.S. Army Research Institute (ARI). Procedure 10 enables the Estimator to adjust the analysis time if the MIST software is used.

MIST saves time and money because it reduces the time required to perform MPT calculations and produce reports. Also, once data have been entered to the data base, these data can be used repeatedly. Sensitivity analyses, tradeoffs, and iterations of the methodology can be accomplished easily and rapidly. MIST also provides camera-ready reports, thereby reducing production costs.

The Estimator should note that the adjustment factors in Table 2.5-19 are accurate for a group of analysts who are both well skilled in the HCM and well skilled in the use of MIST. MIST may initially increase the analysis time because the analysts will need time to learn the software. Once the analysts learn MIST, however, the analysis time will rapidly approach the time savings reflected in the adjustment factors.

The Estimator should also note that MIST's Manpower Model can only support an HCM analysis completed at the development boundary. The model cannot be used at the force structure boundary.

SUBPROCEDURES

Using Worksheet 19:

1. Enter in column B the total analysis time.
2. Multiply the automation adjustment factors in column C by the analysis times in column A and record the product in column D.

Table 2.5-19 is an example of Worksheet 19.

Using Worksheet 20:

1. Enter in column B the total analysis time.
2. Enter in column C the automation time savings.
3. Subtract column C from column B and record the answer in column D.

Table 2.5-20 is an example of Worksheet 20.

The Estimator can now return to Worksheet 16 and adjust the total analysis time to reflect the savings gained by using MIST.

Table 2.5-19. Example of Worksheet 19

WORKSHEET 19: Automation Adjustment Factor

A	B	C	D
HCM Step	Total Analysis Time (Worksheet 15, Col. D)	Automation Adjustment Factor	Automation Time Savings
Systems Analysis	8.75	x .4	= 3.5
Manpower Analysis	5.15	x .6*	= 3.09
Personnel Analysis	1.33	x .75	= 1.00
Training Analysis	8.35	x .4	= 3.34

* The 60% time savings for manpower is based only on the time saved in performing a manpower analysis at the system development boundary.

Table 2.5-20. Example of Worksheet 20

WORKSHEET 20: Summary Table

A	B	C	D
HCM Step	Total Analysis Time (Worksheet 15, Col. D)	Automation Time Savings (Worksheet 19, Col. D)	Adjusted Total Analysis Time
Systems Analysis	8.75	-	5.25
Manpower Analysis	5.15	-	2.06
Personnel Analysis	1.33	-	0.33
Training Analysis	8.35	-	5.01
Management	N/A	N/A	4.15

PROCEDURE 11 - ESTIMATE THE COST OF IMPACT ANALYSIS

DISCUSSION

The HCM analysts have two objectives in Impact Analysis. First, the analysts must review each HCM step's results to ensure their accuracy. The time required for this review is included in the base-analysis time. The analysts' second objective is to assess the New System's impact on the Army's resources. This assessment will increase the time required for the manpower, personnel, and training analyses.

Table 2.5-21 provides the factors for increasing analyst time to include Impact Analysis in the FFII analysis. The analysis times on Table 2.5-21 include the additional data collection and analysis time and report writing time for Impact Analysis. No additional travel is required.

SUBPROCEDURES

Using Worksheet 21:

1. Enter in column B the manpower, personnel, and training impact-analysis times.
2. Enter in column C the analyst skill level adjustment factor from Worksheet 9, column D.
3. Multiply column B by column C and enter the product in column D.

Table 2.5-21 is an example of Worksheet 21.

Using Worksheet 22:

1. Enter in column B the manpower, personnel, and training impact-analysis times.
2. Enter in column C the analyst skill level adjustment time from Worksheet 21, column D.
3. Add column B to column C and enter the sum in column D.
4. Convert man-days to man-months in column E.

Table 2.5-22 is an example of Worksheet 22.

The Estimator must now return to Worksheet 16 and increase the man-month requirements for the manpower, personnel, and training analyses.

Table 2.5-21. Example of Worksheet 21

WORKSHEET 21: Impact Analysis Time Factors

HCM Step	1 - 3 MOSS & Courses	3 - 12 MOSS & Courses	12 - 24 MOSS & Courses	24 - 36 MOSS & Courses	36 - 50 MOSS & Courses
Manpower	3 days	3.5 days	4 days	5 days	5.5 days
Personnel	3 days	3.5 days	4 days	5 days	5.5 days
Training	8 days	12 days	15 days	18 days	20 days

A	B			C	D
HCM Step	Impact Analysis Time (from table above)	Analyst Skill Level Factor (Worksheet 9, Col. D)	Additional Impact Analysis Time for Analyst Skill Level		
Manpower	4 days	x	=	0.0	0.0 man-days
Personnel	4 days	x	=	0.2	0.8 man-day
Training	15 days	x	=	0.2	3.0 man-days

Table 2.5-22. Example of Worksheet 22

WORKSHEET 22: Summary Table

A	B	C	D	E
HCM Step	Impact Analysis Time (Worksheet 21, Col. B)	Adjusted Analysis Time for Skill Level (Worksheet 21, Col. D)	Total Time for Impact Analysis	Convert Man-Days to Man-Months
Manpower	4 days	+ 0.0	= 4.0 man-days	0.20
Personnel	4 days	+ 0.8	= 4.8 man-days	0.24
Training	15 days	+ 3.0	= 18.0 man-days	0.9

PROCEDURE 12: ESTIMATE THE COST OF TRADEOFF ANALYSIS

DISCUSSION

Estimating the additional time required for Step 6, Tradeoff Analysis, is not as straightforward as Impact Analysis. However, the Estimator can apply the cost-estimation procedures to establish the time required for Tradeoff Analysis.

A tradeoff can vary greatly in its scope. One category of Tradeoff Analysis is rough order of magnitude (ROM) analysis. ROM analyses test the sensitivity of HCM products to variations in key parameters. Other tradeoffs can range from minor to major variations in missions and equipment (e.g., system configuration). These other tradeoffs require the HCM analysts to iterate some or all of the first four HCM steps. The discussion in Section 2.4 on alternative configurations is applicable to major tradeoffs of system equipment. Tradeoffs can also consider alternative training concepts and alternative system manning.

SUBPROCEDURES

Because tradeoffs vary in range and depth, there are no set procedures for calculating their cost. However, the Estimator can return to the Analysis Plan and assess the effect the desired tradeoff would have on the analysis parameters. The Estimator would then return to Procedure 1 and add time to each analysis step affected by the desired tradeoff. This additional time can then be carried through the costing procedures.

NOTE

The Estimator should keep in mind that the best time to select tradeoffs is after the base HCM analysis has been completed. Components that are high drivers of MPT resources will have surfaced during the base analysis. The Estimator will also have a better understanding of how the analysis parameters affected the base analysis.

SECTION 3

CONDUCTING AN HCM ANALYSIS

3.1 OVERVIEW

After the HCM analysis has been planned, the analysis team must ensure that the analysis answers the New System's MPT questions. To meet the analysis objectives, the team must follow a Quality Assurance Plan (QAP), develop a Consolidated Data Base (CDB), write comprehensive reports, and determine how the HCM results could "feed" Army MPT documents.

The Quality Assurance Plan, is a series of analysis meetings and reviews (milestones) in which interim analysis results are presented, reviewed, and approved. By conducting this series of meetings, the analysis manager can systematically track analysis progress and stay on schedule. Subsection 3.1 describes the HCM Quality Assurance Plan.

The Consolidated Data Base (CDB), which is described in Subsection 3.2, is a structured repository for HCM analysis information. The CDB, which may or may not be automated, serves several purposes in an HCM analysis, including:

- documenting analysis assumptions and decisions;
- facilitating tradeoffs; and
- providing information for reports.

The HCM analysis team must document the analysis results in a two-volume report. This report should contain a high-level summary of the analysis and detailed results for each HCM step. Subsection 3.3 provides suggested outlines for these reports.

Subsection 3.4 contains "crosswalks" that link HCM products to Army MPT documents. The analysis team should use these crosswalks to tailor HCM results to meet Army information users' needs.

3.2 HCM QUALITY ASSURANCE PLAN (QAP)

The HCM Quality Assurance Plan (QAP) provides the HCM analysis manager with the guidance he or she needs to manage an analysis effectively. The QAP covers the entire HCM, from the initial system description to the final analysis reports.

Figure 3.2-1 shows relationships and timing of the QAP's meetings and reviews. The following pages describe each meeting and review. These descriptions include the:

- individual(s) responsible for coordinating the meeting;
- required participants;
- HCM substeps that should be completed at the time of the meeting/review;
- meeting's/review's purpose;
- tasks that must be completed before the meeting/review; and
- meeting's/review's products.

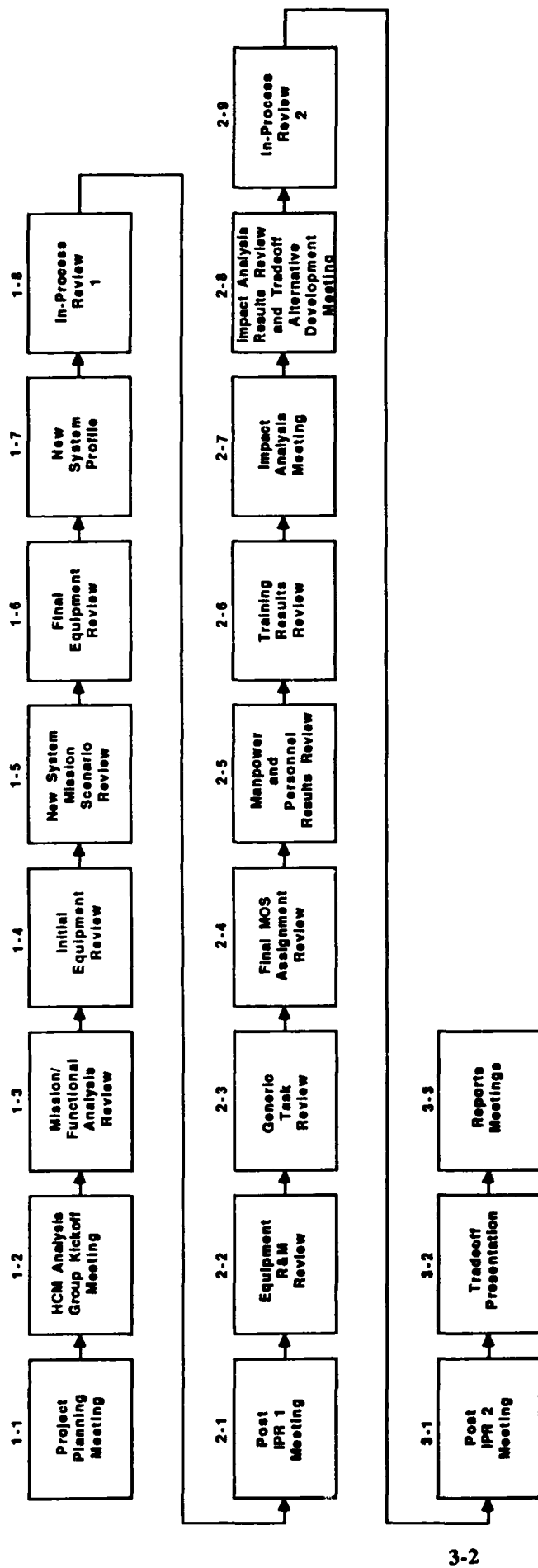


Figure 3.2-1. Quality Assurance Plan.

1-1 PROJECT PLANNING MEETING

Responsibility: Analysis manager, Technical Advisory Group (TAG) chairman
Participants: Analysis manager, HCM analysis team members (as needed), TAG members (as needed).
HCM Substeps: None

Purpose:

The Project Planning Meeting is held to establish and document the analysis assumptions and constraints. The TAG and the HCM analysis manager discuss the HCM Planning Document. If the Army has not already formed a TAG, it should do so at this time, probably in a separate meeting.

Preparation:

Distribute copies of all available documentation to the HCM analysis team; conduct initial "in house" meetings with the team; discuss the analysis in detail with the TAG; and set up the Project Planning Meeting with the TAG chairman.

Products:

- Final HCM Planning Document
- Initial schedules

1-2 HCM ANALYSIS TEAM KICKOFF MEETING

Responsibility: Analysis manager
Participants: HCM analysis team
HCM Substeps: None

Purpose:

The Kickoff Meeting is held to familiarize the HCM analysis team with the system under analysis (the "New System"); the analysis scope; individual assignments; the project plan; the management plan; available documents/data; the data collection plan; Points of Contact (POCs); travel requirements; and the analysis schedule.

Preparation:

Develop project, management, and data collection plans. Prepare a list of POCs and a meeting agenda. Meet with individual analysts to discuss the availability of individuals, schedules, analysis scope, etc.

Products:

- Analysis milestones and completion dates
- Data collection plans
- Personnel assignments

1-3 MISSION/FUNCTIONAL ANALYSIS REVIEW

Responsibility: Engineering analyst
Participants: HCM analysis manager, engineering, manpower, and training analysts
HCM Substeps: 1.1 and 1.3

Purpose:

At this meeting the HCM analysts review and agree on the missions developed in Substep 1.1 and on the functional analysis in Substep 1.3. Once the team members agree on these items, they review System Parameters 6 and 7 in the HCM Analysis Plan. If the analysts encounter discrepancies, the analysis manager contacts the TAG chairman to discuss possible changes.

Preparation:

Complete Substeps 1.1 and 1.3.

Products:

- Final New System missions
- Final New System functional analysis
- Confirmation of or changes to the missions and functional parameters in the HCM Analysis Plan

1-4 INITIAL EQUIPMENT REVIEW

Responsibility: Engineering analyst

Participants: HCM analysis manager, engineering, manpower, and training analysts

HCM Substeps: 1.2; 1.4; and 1.6, Action Step 1

Purpose:

At this meeting the HCM analysts review and agree on the Predecessor System's equipment list developed in Substep 1.2 and the generic equipment identified in Substep 1.4. The analysts make changes to these equipment lists, if necessary, and then review System Parameters 8 and 9 in the HCM Analysis Plan. If the analysts encounter discrepancies, the analysis manager contacts the TAG chairman to discuss possible changes.

At this meeting the analysts also review potential and candidate BCS components identified in Substep 1.6, Action Step 1, and record any additional components. This early review is essential to ensure that the potential BCS components will suit not only the engineering analysis, but the training analysis, as well.

Preparation:

Complete Substeps 1.2 and 1.4 and Action Step 1 of Substep 1.6. Prepare equipment lists and distribute them prior to the meeting.

Products:

- Final Predecessor System equipment list
- Final generic equipment list
- Confirmation of or changes to the HCM Analysis Plan

1-5 NEW SYSTEM MISSION SCENARIO REVIEW

Responsibility: Engineering analyst

Participants: HCM analysis manager, engineering, manpower, and training analysts

HCM Substeps: 1.5

Purpose:

At this meeting the HCM analysts review and agree on the New System's mission scenario, mission events, and usage rate(s). The analysts also review operational concepts, including functional and mission-event sequences. The analysts then review System Parameter 10 in the HCM Analysis Plan. If the analysis team encounters discrepancies, the analysis manager contacts the TAG chairman to discuss possible changes.

Preparation:

Complete Substep 1.5 and distribute operational, organizational, and logistics information prior to the meeting.

Products:

- Final New System mission scenario
- Final New System usage rate(s)
- Confirmation of or changes to the HCM Analysis Plan

1-6 FINAL EQUIPMENT REVIEW

Responsibility: Engineering analyst

Participants: HCM analysis manager, engineering, manpower, and training analysts

HCM Substeps: 1.6 and 1.7.

Purpose:

At this meeting the HCM analysts review and agree on the BCS equipment configuration(s) and the Proposed System equipment configuration(s).

Preparation:

Complete Substeps 1.6 and 1.7 and distribute the BCS and Proposed System equipment lists prior to the meeting.

Products:

- Final BCS and Proposed System equipment lists

1-7 NEW SYSTEM PROFILE REVIEW

Responsibility: HCM analysis manager, manpower and training analysts

Participants: HCM analysis team

HCM Substeps: 2.1, 2.2, and 4.1.

Purpose:

At this meeting the HCM analysts review and agree on the initial MOS assignments, force structure and unit assignment, manpower and personnel concepts, and the training concept/strategy. The analysts then review System Parameters 11, 12, and 13 in the HCM Analysis Plan. If the analysts encounter discrepancies, the analysis manager contacts the TAG chairman to discuss possible changes.

Preparation:

Complete Substeps 2.1, 2.2, and 4.1 and distribute the initial MOS list, manpower and personnel information, and training concepts, and the force structure. The analysis team should also prepare to brief the TAG on these data at IPR I.

Products

- Final manpower, personnel, and training concepts
- Final force structures and units
- Confirmation of or changes to the HCM Analysis Plan

1-8 IN-PROCESS REVIEW I

Responsibility: HCM analysis manager and TAG chairman

Participants: HCM analysis manager, engineering and manpower analysts, TAG chairman, TAG members

HCM Substeps: 1.1 through 1.7, 2.1, 2.2, and 4.1

Purpose:

At this meeting the HCM analysis manager and engineering analysts meet with the TAG to review and agree on the results generated thus far in the analysis. The participants must also agree on the HCM Analysis Plan, thereby finalizing many of the analysis assumptions and constraints. Final agreement on the HCM Analysis Plan is important. New systems are in flux early in their acquisition. However, the HCM analysis requires a system description that will not change.

Preparation:

Prepare for a briefing that includes the results of Substeps 1.1 through 1.7, 2.1, 2.2, and 4.1, and the revised HCM Analysis Plan, if applicable. The analysis manager should conduct an internal review of the briefing prior to the IPR (i.e., a "dry run").

Products:

- Approved HCM Analysis Plan
- Approved Generic, Predecessor System, BCS, Proposed System equipment lists. MOS list
- Approved training, maintenance, and operational concepts
- Approved force structures and units

2-1 POST-IPR I MEETING

Responsibility: HCM analysis manager

Participants: HCM analysis team

HCM Substeps: None

Purpose:

At this meeting the analysis manager provides analysis team members with information about IPR I. Topics to be discussed include:

- (1) a general description of the IPR, e.g., who attended, reactions of participants/customers, etc.;
- (2) specific questions/problems raised;
- (3) assignment of action items; and
- (4) revisions to the HCM project schedule, if necessary.

Preparation:

Distribute relevant documents to the analysis team members prior to the meeting and discuss pertinent IPR issues with individual analysts.

Products:

- Revised HCM assumptions and/or constraints
- Revised HCM schedule (should be sent to the TAG for approval)

2-2 EQUIPMENT RELIABILITY & MAINTAINABILITY REVIEW

Responsibility: Engineering analyst

Participants: HCM analysis manager, engineering, manpower, and training analysts

HCM Substep: 1.9

Purpose:

At this meeting HCM analysis team members review and agree on the reliability and maintainability (R&M) data developed in Substep 1.9 for the Predecessor System (when applicable), BCS, and Proposed System(s). The analysts should check values that were extrapolated from BCS component data carefully to ensure that the design differences were handled properly.

The analysts also finalize the equipment maintenance ratios at this meeting. The manpower analysts will use these ratios to develop workload and manpower requirements.

Preparation:

Complete Substep 1.9 and distribute Predecessor System, BCS, and Proposed System(s) R&M information prior to the meeting.

Products:

- Final design differences and equipment R&M values for the Predecessor System (when applicable), BCS, and Proposed System(s)

2-3 GENERIC TASK REVIEW

Responsibility: Engineering, manpower, and training analysts

Participants: HCM analysis manager, engineering, manpower, and training analysts

HCM Substep: 1.8

Purpose:

At this meeting HCM analysis team members review and agree on the generic maintainer and operator task lists generated in Substep 1.8.

Preparation:

Complete Substep 1.8.

Products:

- Final generic maintainer and operator task lists

2-4 FINAL MOS ASSIGNMENT REVIEW

Responsibility: Manpower and training analysts

Participants: HCM analysis manager, engineering, manpower, and training analysts

HCM Substeps: 2.3, Action Step 3; 2.4, Action Step 3

Purpose:

At this meeting HCM analysis team members review and agree on the MOS/ASI job/duty assignments and examine the assigned skill levels/paygrades.

Preparation:

Complete Action Step 3 of Substep 2.3 and Action Step 3 of Substep 2.4 and distribute the results prior to the meeting.

Products:

- Final MOS/ASI assignments
- Final skill level/paygrade assignments

2-5 MANPOWER AND PERSONNEL RESULTS REVIEW

Responsibility: Manpower and personnel analysts
Participants: HCM analysis team
HCM Substeps: 2.1 through 2.5 and 3.1 through 3.4

Purpose:

At this meeting the HCM analysts review and agree on the manpower and personnel results generated in Steps 2 and 3. This meeting should also serve as the pre-IPR II internal review of these steps.

Preparation:

Complete Steps 2 and 3 and distribute the results prior to the meeting. The analysis manager should also prepare a draft of the briefing he or she will present at IPR II.

Products:

- Final Step 2 and 3 results

2-6 TRAINING RESULTS REVIEW

Responsibility: Training analyst

Participants: HCM analysis manager, manpower and training analysts

HCM Substeps: 4.1 through 4.9

Purpose:

At this meeting HCM analysis team members review and agree on the training results generated in Step 4. This meeting should also serve as the pre-IPR II internal review of this step.

Preparation:

Complete Step 4 and distribute its results prior to the meeting. The analysis manager should also prepare a draft of the briefing he or she will present at IPR II.

Products:

- Final Step 4 results

2-7 IMPACT ANALYSIS MEETING

Responsibility: HCM analysis manager

Participants: HCM analysis team

HCM Substeps: None

Purpose:

At this meeting the HCM analysis team examines the analysis results to determine those areas where impact analysis is appropriate.

Preparation:

Prior to the meeting each analysis group should examine its own step to identify areas where impact analysis may be needed.

Products:

- Impact analysis assignments for individual analysts

2-8 IMPACT ANALYSIS RESULTS REVIEW AND TRADEOFF ALTERNATIVE DEVELOPMENT MEETING

Responsibility: HCM analysis manager
Participants: HCM analysis team
HCM Substeps: 5.1 through 5.4, as applicable

Purpose:

At this meeting the HCM analysis team members review, interpret, and agree on the impact analysis results from Step 5. The analysts develop tradeoff alternatives based on these results and the results from Steps 1 through 4.

Preparation:

Complete Step 5, Impact Analysis, and distribute its results prior to the meeting.

Products:

- Impact analysis results
- Tradeoff alternatives

2-9 IN-PROCESS REVIEW II

Responsibility: HCM analysis manager, TAG chairman
Participants: HCM analysis team, TAG chairman, TAG members
HCM Steps: 1, 2, 3, 4, and 5

Purpose:

At this meeting the HCM analysis team members meet with the TAG to review and agree on the HCM analysis results. The participants review the results of HCM Steps 1 (if required), 2, 3, 4, and 5 and select analysis tradeoffs.

Preparation:

Prepare a briefing that includes results from Steps 2 through 5. The analysis manager should conduct an internal review of the briefing prior to the IPR (i.e., a "dry run").

Products:

- Final analysis results for Steps 1 through 5*
- Analysis tradeoffs

* In some cases the HCM analysts may need to conduct additional analyses before the results of Steps 2 through 5 are considered final.

3-1 POST-IPR II MEETING

Responsibility: HCM analysis manager

Participants: HCM analysis team

HCM Substeps: None

Purpose:

At this meeting the analysis manager provides the analysis team members with information about IPR II. Topics to be discussed include:

- (1) a general description of the IPR, e.g., who attended, reactions of participants/customers, etc.;
- (2) specific questions/problems raised;
- (3) assignment of action items;
- (4) revisions to the HCM project schedule, if necessary; and
- (5) assignment of tradeoff tasks.

Preparation:

Distribute relevant documents to the analysis team prior to the meeting and discuss pertinent IPR issues with individual analysts.

Products:

- Tradeoff task assignments
- Revised HCM schedule

3-2 TRADEOFF PRESENTATION

Responsibility: HCM analysis manager and TAG chairman

Participants: HCM analysis manager; HCM analysis team members, as required;
TAG chairman; and TAG members, as required

HCM Substeps: 6.1 through 6.3, as required

Purpose:

At this meeting the HCM analysis manager and other team members (as needed) meet with the TAG to review the tradeoff analysis results.

Preparation:

Prepare a briefing that includes the results of Step 6, Tradeoff Analysis. The analysis manager should conduct an internal review of the briefing prior to the IPR (i.e., a "dry run").

Products:

- Final analysis results

3-3 REPORT MEETINGS

Responsibility: HCM analysis manager
Participants: HCM analysis team members, as required; production staff
HCM Substeps: None

Purpose:

At these meetings the HCM analysis team members determine the report-writing strategy, writing assignments, and schedule. They also solve any problems they may encounter while preparing the reports.

Preparation:

Determine writing assignments and schedule.

Products:

- The products of these meetings depend on the questions that may arise during the writing of reports.

3.3 ESTABLISHING AND STRUCTURING THE CONSOLIDATED DATA BASE (CDB)

During an HCM analysis, the analysis team should develop and maintain a Consolidated Data Base (CDB). The CDB serves as an audit trail of the analysis.

The analysis manager's first step in establishing the CDB is to determine which data the analysis requires. Table 3.3-1 lists generic data categories required for a standard HCM analysis. The analysis manager must examine these categories and select those elements that support the analysis scope. The HCM analysis manager and analysts must also determine how detailed the data must be to support the analysis scope.

Once the HCM analysts have identified the required data, they determine potential data sources and create data source indexes. A data source index is a table that describes the source of the detailed data. The HCM analysts develop a data source index for each step in the HCM. Data sources in each index are grouped according to major functional categories. Table 3.3-2 presents an example of a data source index.

The analysts then obtain sample data products from each source. The manager and analysts examine each product for relevance and completeness and select the best source. The analysis team can then request a comprehensive set of the required data from this source.

As the data are received, the analysts must develop a data management structure that provides an ordered, convenient means for storing and retrieving the data.

3.4 REPORT INFORMATION

Each HCM analysis will yield different results. These analysis results are best presented in a two-volume report. The first volume, the "Executive Summary," outlines the "bottom-line" answers to MPT issues and questions. The second volume is a detailed explanation of how the analysis was conducted and how its results were derived.

The Executive Summary contains the following information:

- Analysis overview
- Analysis scope
- Systems Analysis (Step 1) results
- Manpower Requirements Analysis (Step 2) results
- Personnel Pipeline Analysis (Step 3) results
- Training Resource Requirements Analysis (Step 4) results
- Impact Analysis (Step 5) results
- Tradeoff Analysis (Step 6) results
- HCM Products to MPT Documents Crosswalks
- Appendices

Table 3.3-1. Generic HCM Data Categories.

General - DoD & Army Regulations, Standards, Manuals, etc. Comparable & New System			
FUNCTIONAL REQUIREMENTS	EQUIPMENT	MANPOWER	
<ul style="list-style-type: none"> • Functional Requirements • System Performance Measures • Mission Requirements • Operational Concept • Support Concept 	<ul style="list-style-type: none"> • Equipment Breakdown Structure • Maintenance Data • Reliability Data • Number Supported at Each Maintenance Level • Software Requirements 	<ul style="list-style-type: none"> • Workload Data • Position Planning Factors • MOS/CMF Data 	
TASKS	TRAINING	PERSONNEL	
<ul style="list-style-type: none"> • Task Elements • Difficulty Importance Frequency • Skills and Knowledge • Tool/Test Equipment 	<ul style="list-style-type: none"> • Course Outlines • Programs of Instruction • Training Paths • Instructor Planning Factors • Course Costs • Student Input Requirements • Methods and Media 	<ul style="list-style-type: none"> • Career Path Information • Personnel Pipeline Characteristics • Personnel Overhead Factors 	

Table 3.3-2. Sample Page from Data Source Index.

SUBJECT	DATA	SOURCE	SOURCE LOCATION	COMMENTS
1. Functional Requirements Information	List of system missions	All addressed to varying degrees in:		
	Mission scenario	MAA	AMC, DRCDE-A	See pages C-1 and C-2
	Weapon system requirements	O&O	Attn: DRCDE-A	
	Description of system constraints, guidelines, and goals	JMSNS		
	Projected operational environments	LA	TRADOC, Attn: ATCD-E	
2. Design	Functional requirements	ROC		
	Acquisition schedule	see also: Statement of Work within the system RFP		
	Description of Predecessor System	Project Office	Procuring Agency, PM, TSM	
	Description of BCS subsystems	Operations and technical manuals	Procuring Agency	
	Description of new technologies	Operations and technical manuals	Procuring Agency	
		Engineering studies, SMEs, R&D studies	DTIC, Contractors	
		Feasibility and concept exploration studies	Laboratories within the Materiel Development Command	
			System Command HQ (Naval Air/Sea/ Electronics/etc. Systems Command)	Military and non-profit

The second volume presents much of the same information as the first volume, except it provides more detail.

3.5 HCM - MPT DOCUMENT CROSSWALKS

Estimating the New System's MPT requirements is an interactive process. HCM analysts depend on the Army for information; the Army relies on the HCM analysts to provide accurate MPT information. The HCM produces an extensive amount of information that supports the Army's estimation of MPT requirements. Table 3.5-1 lists some of the information that an HCM analysis provides to the Army.

The Qualitative and Quantitative Requirements Information (QQPRI), the Basis of Issue Plan (BOIP), and other acquisition documents are important information sources for many of the HCM's steps. The role these documents will play in the analysis will vary depending on the New System's location in the acquisition process. The New System's maturity influences the quantity and quality of available information. If the HCM analysis is conducted early in the acquisition process, MPT documents may not be complete and the HCM's results can feed these documents directly. If, however, the New System is later in the acquisition process, the MPT documents will be more complete. The HCM can then be used to test the projections and assumptions in these documents.

Tables 3.5-2 through 3.5-5 are HCM-MPT "crosswalks" for each HCM step. These crosswalks list each HCM step's products and the MPT documents that these products could feed. The crosswalks should be included in the executive summary report.

An HCM analysis also provides information required by the Army System Acquisition Review Council (ASARC). Table 3.5-6 lists ASARC requirements that the HCM can estimate.

Table 3.5-1. HCM Products

- Answers to specific MPT questions and issues related to the New System
- Quantified manpower requirements (number of soldiers)
- Qualified manpower requirements (by MOS and skill level)
- Quantified personnel sustainment requirements
- Personnel considerations that require close evaluation and future monitoring
- Projected training increases (by MOS and course)
- Annual instructor requirements (by course)
- Projected annual training costs (by course and by MOS)
- Initial Logistic Support Analysis data
- Issues and alternatives for tradeoffs between design and MPT supportability
- Source selection and evaluation
- Human resource/equipment design tradeoffs
- Updates and assessments of the O&O Plan
- Tentative/Final QQPRI and BOIP feeder data development or verification of QQPRI/BOIP decisions
- Input for COEA development
- Input for STRAP and ITP
- Input to MANPRINT process
- Input for human resource operational and developmental test (OT/DT) issues

Table 3.5-2. HCM - MPT Documents Crosswalk for Systems Analysis

Substep	Action Step	HCM Products	MPT Documents
1.1	1	• System Missions	• LSA, Task 201
1.2	1	• Predecessor System Equipment	• LSA, Tasks 203 and 302
	2	• Proposed New System Designs	
1.3	1, 2, 3	• New System Functions	• LSA, Task 301
	4	• New System Functional Requirements	• LSA, Task 301
	5	• Functional Allocation	• LSA, Task 301
1.4	1	• Generic Equipment	• BOIPFD, 4a • LSA, Task 203 • BOIP 19b, 20a
1.5	1	• Function Time Lines	
	2	• Mission Events	• LSA, Task 201
	3	• Operating Metrics	• LSA, Task 201
	4	• Usage Rates	• OMS/MP

Table 3.5-2. HCM - MPT Documents Crosswalk for Systems Analysis (Continued)

Substep	Action Step	HCM Products	MPT Documents
1.6	1,2	<ul style="list-style-type: none"> • BCS Components for Workload Analysis 	<ul style="list-style-type: none"> • LSA, Tasks 203, 204 and 205 • BOIPFD, 11e • BOIPFD, 9 and 12
	3	<ul style="list-style-type: none"> • BCS Components for Training Analysis 	
1.7	1	<ul style="list-style-type: none"> • New System Designs 	<ul style="list-style-type: none"> • LSA, Tasks 203,204,205, and 302
	2	<ul style="list-style-type: none"> • BCS Performance Deficiencies 	<ul style="list-style-type: none"> • LSA, Tasks 203, 204, and 205
	3	<ul style="list-style-type: none"> • Proposed System Equipment 	<ul style="list-style-type: none"> • LSA, Tasks 204 and 302 • QQPRI, Second Requirement
1.8	1	<ul style="list-style-type: none"> • Operator Tasks 	<ul style="list-style-type: none"> • LSA, Task 401 • TAD
	2	<ul style="list-style-type: none"> • Maintainer Tasks 	<ul style="list-style-type: none"> • LSA, Task 401 • TAD
1.9	1	<ul style="list-style-type: none"> • Predecessor System Maintenance Ratios 	
	2	<ul style="list-style-type: none"> • BCS Maintenance Ratios 	<ul style="list-style-type: none"> • LSA, Task 203
	3	<ul style="list-style-type: none"> • Proposed System Maintenance Ratios 	<ul style="list-style-type: none"> • LSA, Tasks 203 and 204

Table 3.5-3. HCM - MPT Documents Crosswalk for Manpower

Substep	Action Step	HCM Products	MPT Documents
2.1	1	• Operator MOSS, ASIs, and Duty Positions	
	2	• Maintainer MOSS and ASIs	
2.2	1	• Steady-State Force Structures	<ul style="list-style-type: none"> • BOIP, 6D • O&O Plan • TAADS • FAS
	2	• Deployment/Retirement System Distribution	• Materiel Fielding Plan
2.3	1	• Direct Maintenance Workload	<ul style="list-style-type: none"> • QQPRI, Third Requirement • LSA, Task 401 and 402
	2	• Updated Maintainer MOSS	<ul style="list-style-type: none"> • QQPRI, Fifth Requirement • BOIP 21a and b • AR611-201 • TOE
	3	• Maintenance Workload by MOS	<ul style="list-style-type: none"> • QQPRI • TM
	4	• Available Productive Man-Hours	
	5	• Maintainer Manpower	<ul style="list-style-type: none"> • LSA, Task 303 and 402 • BOIP, 6L • AR611-201 • AR570-2 • TOE • TAADS • QQPRI

Table 3.5-3. HCM - MPT Documents Crosswalk for Manpower (Continued)

Substep	Action Step	HCM Products	MPT Documents
2.3	6	• Deployment/Retirement Maintainer Manpower	• TAADS • TOE • QQPRI • AR611-201
	7	• Combat Damage Manpower	
2.4	1	• Operator Task Timelines	
	2	• Operator Workload	• QQPRI, Fourth Requirement • TM • AR570-2 • AR611-201
	3	• Updated Operator MOSSs, ASIs, and Duty Positions	• QQPRI, Fifth Requirement • BOIP, 21a and b. O&O Plan • AR611-201 • TOE
	4	• Operator/Crew Workload by MOS	• QQPRI, Sixth Requirement • AR611-201 • AR570-2 • O&O Plan
	5	• Available Productive Man-Hours	
	6	• Operator/Crew Manpower	• AR611-201 • AR570-2 • QQPRI, Fourth Requirement • BOIP, 6L • O&O Plan
2.5	7	• Deployment/Retirement Operator/Crew Manpower	• Materiel Fielding Plan • TAADS • TOE • QQPRI • AR611-201
	1	• Standard Position, Policy-Driven, and Supervisory Manpower	• AR570-2 • AR611-201 • TOE

**Table 3.5-4. HCM - MPT Documents Crosswalk for
Personnel Pipeline Analysis**

Substep	Action Step	HCM Products	MPT Documents
3.1	1	<ul style="list-style-type: none"> Existing MOS Descriptions 	<ul style="list-style-type: none"> TAD AR611-201
	2	<ul style="list-style-type: none"> Revised MOS Descriptions 	<ul style="list-style-type: none"> QQPRI O&O Plan TAD AR611-201
3.2	1	<ul style="list-style-type: none"> Promotion, Migration, and Attrition Rates 	
	2	<ul style="list-style-type: none"> Translents, Trainees, Holders, and Students (TTHS) Rates 	
	3	<ul style="list-style-type: none"> MOSs with Missing or Faulty Flow Rates 	
3.3	1	<ul style="list-style-type: none"> Comparable Flow Rates from a Comparable MOS 	
	2	<ul style="list-style-type: none"> Comparable Flow Rates from Averaging a CMF's Rates 	
3.4	1	<ul style="list-style-type: none"> TTHS Adjusted Manpower Requirements 	
	2	<ul style="list-style-type: none"> Personnel Requirements 	<ul style="list-style-type: none"> LSA, Tasks 303 and 402
	3	<ul style="list-style-type: none"> Intake to Paygrade 	<ul style="list-style-type: none"> ARPRINT SMDR

Table 3.5-5. HCM - MPT Crosswalk for Training

Substep	Action Step	HCM Products	MPT Documents
4.1	1	• Operator and Maintainer Training Source Indexes	
	2	• New System Training Concept	• STRAP • ITS
4.2	1	• Predecessor System Tasks	• LSA
	2	• BCS Tasks	• LSA
	3	• Proposed System Tasks	• LSA • QQPRI • AETIS • ARTEP
	4	• Tasks Assigned to Training	• LSA • NETP • AETIS • ARTEP
4.3	1	• Predecessor System Programs of Instruction	
	2	• BCS Programs of Instruction	
	3	• Proposed System Quasi-Programs of Instruction	• NETP • STRAP • ITS • QQPRI • CRP
	4	• ASVAB Prerequisites	• CRP • QQPRI

Table 3.5-5. HCM - MPT Crosswalk for Training (Continued)

Substep	Action Step	Data Elements	MPT Documents
4.4	1	• Training Devices and Equipment	• ITS • NETP
	2	• Facilities	• ITS • NETP
	3	• Ammunition	• ITS
	4	• Fuel	
4.5	1 & 2	• Course Resource Data (Student Input, Course Attrition Rate, Modal Grades, Course Length, Optimum Class Size, Course Type, and One Time Instructor Contact Hours)	• ITS • NETP • CRP
4.6	1	• Normalized Graduates	
	2	• Student Inputs	• ITS • NETP • STRAP
4.7	1	• Training Man-Days	• NETP
	2 & 3	• Number of Instructors	• NETP

Table 3.5-5. HCM - MPT Crosswalk for Training (Continued)

Substep	Action Step	Data Elements	MPT Documents
4.8	1	• Fixed and Variable Cost Percentages	
	2	• Course Material Costs	• NETP
	3	• Cost per Graduate	• NETP
	4	• Annual Course Costs	• NETP • STRAP
4.9	1 & 2	• Unit Training Products Resource Requirements	• STRAP • AETIS

Table 3.5-6. HCM Products that Meet ASARC Requirements

ASARC I

- Organizational and Operational Concept
- Operator and Maintainer Manning
- Training Implications Summary
- Manpower Evaluation (tradeoffs)

ASARC II

- Manpower Estimate (unit manning, contractor support, depot workload, force impacts)
- Manpower Tradeoff Analysis
- Comparison of the Predecessor System's and New System's Manpower Requirements
- Manpower Requirements as a Function of R&M Goals and Usage Rates
- Identification of New MOSs
- Training Requirements
- Number of Personnel to be Trained
- Training Costs

ASARC III

- Refined Estimates

APPENDIX A: ACRONYMS AND ABBREVIATIONS

ACCP	Army Correspondence Course Program
AETIS	Army Extension Training Information System
APU	Auxiliary Power Unit
ARI	Army Research Institute
ARTEP	Army Training and Evaluation Program
ASARC	Army System Acquisition Review Council
ASL	Authorized Stockage List
ASSET	Acquisition of Supportable Systems Evaluation Technology
ATTRS	Army Training Requirements Resource System
AVUM	Aviation Unit Maintenance
AVIM	Aviation Intermediate Maintenance
BCS	Baseline Comparison System
BIT	Built-In Test
BITE	Built-In Test Equipment
BOIP	Basis of Issue Plan
CDB	Consolidated Data Base
CHRT	Coordinated Human Resource Technology
COEA	Cost and Operational Effectiveness Analysis
COMSEC	Communications Security
CRP	Course Revision Plan
CTEA	Cost and Training Effectiveness Analysis
CUCV	Commercial Utility Cargo Vehicle
DCD	Directorate of Combat Development
DIVARTY	Division Artillery
DoD	Department of Defense
DS	Direct Support
ECM	Electronic Countermeasure
FFII	FIREFINDER II
GS	General Support
HARDMAN	Hardware versus Manpower
HCM	HARDMAN Comparability Methodology
HHB	Headquarters and Headquarters Battery
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HNS	Host Nation Support
ICTP	Individual and Collective Training Plan
IOC	Initial Operational Capability
IPR	In-Process Review
ITS	Individual Training Strategy
JPL	Jet Propulsion Laboratory

LCSMM	Life Cycle System Management Model
LRRDAP	Long-Range Research and Development Acquisition Plan
LRU	Line Replaceable Units
LSA	Logistic Support Analysis
MAC	Maintenance Allocation Charts
MANPRINT	Manpower and Personnel Integration
MIST	Man Integrated Systems Technology
MLRS	Multiple Launch Rocket System
MOS	Military Occupational Specialty
MPT	Manpower, Personnel, and Training
MST	Maintenance Support Team
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological, Chemical
NDI	Non-Developmental Item
NETP	New Equipment Training Plan
NSTO	New System Training Office
O&O	Organizational and Operational
ODC	Other Direct Cost
OT/DT	Operational and Developmental Test
PCB	Printed Circuit Boards
PIP	Product Improvement Program
PLRS	Position-Locating Reference System
POC	Point of Contact
QAP	Quality Assurance Plan
QQPRI	Quantitative Personnel Requirements Information
R&M	Reliability and Maintainability
ROC	Required Operational Capability
SME	Subject-Matter Expert
SMMP	System MANPRINT Management Plan
SOW	Statement of Work
SQT	Skill Qualification Test
SSC-NCR	Soldier Support Center - National Capital Region
STRAP	System Training Plan
TAB	Target Acquisition Battery
TADV	Trailing Arm Drive Vehicles
TAG	Technical Advisory Group
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
TRRA	Training Resource Requirements Analysis
USAFAS	US Army Field Artillery School
VCSA	Vice Chief of Staff of the Army

APPENDIX B: GLOSSARY

Analysis Scope The boundaries of the HCM analysis.

Audit Trail A systematic mechanism for tracking development of MPT requirements and monitoring changes to the data, assumptions, procedures that produce the MPT requirements.

Baseline Comparison System (BCS) A current operational system, or a composite of current operational subsystems that most closely represents the design, operational, and support characteristics of the New System (MIL-STD-1388-1A).

Comparability Analysis The process by which estimates of an emerging weapon system's human-resource requirements are derived from the known requirements of similar operational systems and subsystems.

Consolidated Data Base A repository of analysis data, results, worksheets, and assumptions that serves as the analysis audit trail.

FIREFINDER II A target location radar system, which is used in the Overview and Manager's Guide as the sample New System.

Footprint The resources of an earlier system within which a new system must fit or closely match.

Force Structure The composition, by numbers and types of units, of an existing, planned, or programmed force, or of the entire Army (AR 310-25).

Front-End Analysis The process of assessing what impacts the manpower, personnel, and training requirements of an emerging system will have on present and projected resources.

Hardware versus Manpower (HARDMAN) Comparability Methodology A six-step process for determining a weapon system's manpower, personnel, and training requirements.

HCM Analysis Plan A document that defines the analysis scope to guide the analysis team and provide input to costing an HCM analysis.

High Driver A system element that consumes a large proportion of MPT resources.

Impact Analysis Analysis of the effect of the New System's projected MPT requirements on available MPT resources.

In-Process Review A meeting between the HCM analysis team and the Technical Advisory Group. The purpose of the meeting is to review results and resolve problems.

MPT Questions List A critical element in the HCM analysis planning process that identifies the MPT questions the HCM analysis must answer.

Man Integrated Systems Technology (MIST) A software tool that can be used in conjunction with the HCM to determine a New System's MPT requirements.

Manpower The total demand, expressed in terms of the number of individuals, associated with a system (MIL-STD-1388-1A). That is, the number of individuals in each MOS, ASI, skill level, and paygrade required to operate and maintain a system.

MANPRINT An Army initiative to integrate human factors engineering; manpower, personnel, and training; health hazard assessment; and system safety to improve soldier performance and total system performance throughout the materiel-development process.

Mission A clear, concise statement of a task or tasks to be accomplished.

New System (1) The system that is replacing the Predecessor System, and (2) the system being studied in a HARDMAN Comparability Methodology (HCM) analysis.

Personnel Pipeline The personnel structure that must be maintained to ensure that manpower requirements are met.

Predecessor System An existing system that is performing a mission or missions that will eventually be performed by the New System.

Product Improvement Program (PIP) Modification or modernization of a program after it has been fielded. PIPs can correct deficiencies, improve performance or capabilities, and extend service life (TRADOC Pam 11-8).

Proposed System An analytical construct used to determine the functional requirements of a New System. It incorporates technological advances likely to exist before the system's projected initial operational capability date.

Quality Assurance Plan (QAP) A management tool that provides the analysis manager with a structure in which to manage the HCM analysis.

Steady-State Condition A weapon system is in a steady-state condition when it is completely fielded and its supporting organizations have stabilized.

System Parameters A New System characteristic that affects the HCM analysis planning process.

System Scope A precise definition of the range and depth of a weapon system.

Systems Analysis An orderly approach to helping a decision maker choose a course of action. Its basis is a model or idealized description of the situation under analysis.

Technical Advisory Group An Army group with interest in the HCM analysis.

Tradeoff Analysis An analysis conducted among a number of system alternatives. In an MPT front-end analysis, the goal is to determine the alternative that has the least impact on MPT, while still providing performance and availability rates required by the system to accomplish its missions.

Training Resource Requirements Analysis (TRRA) A process used to estimate the New System's training requirements. These estimates include specification of the system's task, course, and resource requirements.

Unit (1) Any military element whose structure is prescribed by competent authority, such as a Table of Organization and Equipment; specifically, part of an organization. (2) An organizational title of a subdivision of a group in a task force. (3) A standard of basic quantity into which an item of supply is divided, issued, or used. In this meaning, also called a unit of issue (JCS Pub 1).

Usage Rate The amount of system usage in miles driven, rounds fired, hours operated, etc., required over time to accomplish the system's missions.

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AFR 39-1	Airman Classification
AR 50-5	USAF Formal Schools Catalog
AR 310-3	Preparation, Coordination, and Approval of Department of the Army Publications
AR 310-25	Dictionary of United States Army Terms
AR 350-10	Management of Army Individual Training Requirements and Resources
AR 570-2	Manpower Requirements Criteria (MARC): Tables of Organization and Equipment
AR 602-2	Manpower and Personnel Integration (MANPRINT) in the Materiel Acquisition Process
AR 611-201	Enlisted Career Management Fields and Military Occupational Specialties
AR 750-37	Sample Data Collection: The Army Maintenance Management System
AR 1000-1	Basic Policies for Systems Acquisition
ATRM-159	MOS Course Cost Report (See TRADOC Reg 11-5)
COPO 45 Report	Chief of Personnel Operations 45 Report (published quarterly by MILPERCEN)
DA Pam 11-25	Life Cycle System Management Model for Army Systems
DA Pam 25-30	Consolidated Index of Army Publications and Blank Forms
DA Pam 310-12	Index and Description of Army Training Devices
DA Pam 310-32	Index of Graphic Training Aids (GTAs)
DA Pam 350-100	Extension Training Materials Consolidated MOS Catalog
DA Pam 351-4	U.S. Army Formal Schools Catalog
DA Pam 351-20	Army Correspondence Course Program Catalog
DA Pam 570-555	Staffing Guide for U.S. Army Centers
DA Pam 570-558	Staffing Guide for U.S. Army Service Schools

DA Pam 700-127	Integrated Logistic Support Management Model and Glossary
DoD 5040.2	DoD Catalog of Audiovisual (AV) Productions
FM 6-20	Fire Support in Combined Arms Operation
MIL-STD 881	Work Breakdown Structure for Defense Materiel Items
MIL-STD-1388-1A	Logistic Support Analysis
MIL-STD-1388-2A	DoD Requirements for a Logistic Support Analysis Record
NAVEDTRA 10500	Catalog of Navy Training Courses (CANTRAC)
OMB Cir A-109	Major Systems Acquisition
OPNAVIST 4790.4	Ship's Maintenance and Materiel Management (3M) Program
TB 750-93-1	Functional Group Codes: Combat, Tactical, Support Vehicles and Special-Purpose Equipment
TRADOC Pam 71-9	TRADOC Training Devices for Armywide Use
TRADOC Pam 310-3	TRADOC Armywide Doctrinal and Training Literature
TRADOC Pam 351-4	Job and Task Analysis Handbook
TRADOC Pam 415-1	Winning Approval for Construction and Renovation Needs of U.S. Army Service Schools
TRADOC Reg 11-5	Cost Analysis Program (MOS/FMS Training Costs)
TRADOC Reg 351-1	Training Requirements Analysis System (TRAS)
TRADOC Reg 351-6	Support of Training in Units
TRADOC Reg 351-9	Systems Training Development
TRADOC Reg 351-11	Soldier Training Publications (STP)
TRADOC/AMC Pam 70-11	Reliability, Availability, Maintainability Rationale Report Handbook

APPENDIX D:
BLANK WORKSHEETS

WORKSHEET 1: Base-Analysis Time Estimation

NEW SYSTEM		SYSTEMS ANALYSIS		MANPOWER ANALYSIS		PERSONNEL ANALYSIS		TRAINING ANALYSIS		Base Analysis Time
Analysis Parameter	Quantity	Man-Day Multiplier	Analysis Time	Man-Day Multiplier	Analysis Time	Man-Day Multiplier	Analysis Time	Man-Day Multiplier	Analysis Time	
A	B	C	D	E	F	G	H	I	J	K
New System										
Missions		1 per 1		3 per 1						
Commodities		2 per 1								
Equipment		.5 per 1								
Usage Rates		2 per 1		1 per 1						
Maintenance Levels		6 per 1		5 per 1						
MOSs		2 per 1		1 per 1						
Courses										
Units				1st unit 10 days all units (including 1st) .5 day additional		1 per 1		4 per 1		
OPTIONAL										
RAM Predecessor										
Equipment		.5 per 1								
Combat Damage										
MOSs				1 per 1						
Reserve/NG										
Manpower										
Units				1 per 1						
Deployment/Retirement										
Fielding Intervals										
Task Comparability				.5 per 1						
MOS								40 per 1		
Unit Training Products								20 per 1		
MOS								.5 per 1		
Aptitude								30 per 1		
Modified/New POIs										
Course Materials										
POIs										
Total Man-Days										
Total Man-Months (divide by 20)										

WORKSHEET 2: Alternative Systems Adjustment Factors

Analysis Complexity						
← (LESS)			(MORE) →			
Lack of Predecessor System	BCS Alternative #1	BCS Alternative #2	BCS Alternative #3	Proposed System Alternative #1	Proposed System Alternative #2	Proposed System Alternative #3
.3	Included In Base-Analysis Time	.1	.05*	.1	.05	.05

* (NOTE: The adjustment factor for two BCS alternatives would be $.1 + .05 = .15$ (15%), and the adjustment factor for three Proposed System alternatives would be $.1 + .05 + .05 = .2$ (20%).)

A	B	C	D	E	F	G
HCM STEP	Base-Analysis Time (Worksheet 1, Cols. D, F, H, J)	BCS Adjustment Factor	Multiple BCS Analysis Time	Base-Analysis Time (Worksheet 1, Cols. D, F, H, J)	Proposed System Adjustment Factor	Proposed System Analysis Time
Systems Analysis	x	=	=	x	=	=
Manpower	x	=	=	x	=	=
Personnel	x	=	=	x	=	=
Training	x	=	=	x	=	=

WORKSHEET 3: Summary Table

A	B	C	D
HCM Step	Base-Analysis Time (Worksheet 1, Cols. D,F,H,J)	System Alternatives (Worksheet 2, Cols. D & G)	Adjusted Base- Analysis Time
Systems Analysis	+	+	=
Manpower Analysis	+	+	=
Personnel Analysis	+	+	=
Training Analysis	+	+	=

WORKSHEET 4: Systems Analysis Data Collection and Analysis Adjustment Factors

← (Less)		Analysis Complexity			(More) →
Fielded Equipment with MARC Data	Fielded Equipment with SDC Data	Fielded Equipment with Navy 3M or USAF 66-1 Data	Contractor-Supplied RAM Data	NDI System	• New Technology • Depot Level Maintenance
.1	.2	.4	.5	.6	.7

A		B	C
Systems Analysis Detailed Base-Analysis Time	Adjustment Factor	Systems Analysis Data Collection and Analysis Time	
Electronics (Radar)	x	=	
Electronics (Comm.)	x	=	
Mechanical (Platform)	x	=	
Environmental & Power	x	=	
Other	_____	x	=
Total Man-Months			

WORKSHEET 5: Manpower Data Collection and Analysis Adjustment Factors

Analysis Complexity (More) →			
← (Less)	Type 1 MOS	Type 2 MOS	Type 3 MOS
	Current MOS In AR611-201	Supervisors and Technical Inspectors (Additional Skill Levels)	Consolidation of Two or More Current MOSs In AR611-201
	Type 1 MOS	Type 2 MOS	Type 4 MOS
			New MOS
	.1	.2	.3
		.25	

Factors for Optional HCM Procedures
.2 for Combat Damage Analysis Time
.1 for Reserve/NG Analysis Time
.1 for Deployment/Retirement Analysis Time

A	B	C
Manpower Analysis Detailed Base Analysis Time	Adjustment Factor	Manpower Analysis Data Collection and Analysis Time
(Type 3)	x	=
(Type 2)	x	=
(Type 1)	x	=
Combat Damage Analysis Time	x	=
Reserve/NG Analysis Time	x	=
Deployment/Retirement Analysis Time	x	=
Total Man-Days		
Total Man-Months		

**WORKSHEET 6: Personnel Data Collection and Analysis
Adjustment Factors**

Type 1 MOS Current MOS Attrition/Promotion/Migration/ TTHS Data Available	Type 2, 3, or 4 MOS Consolidation or Development of Comparable Rate Data
.1	.2

A	B	C
Personnel Analysis Detailed Base- Analysis Time	Adjustment Factor	Personnel Analysis Data Collection and Analysis Time
(Type 1 MOSS)	x	=
(Type 2 MOSS)	x	=
(Type 3 MOSS)	x	=
Total Man-Days		
Total Man-Months		

WORKSHEET 7: Training Data Collection and Analysis Adjustment Factors

← (Less)		Analysis Complexity			(More) →
Type 1 Course Current Approved Course POI	Type 2 Course Established Course POI Not Approved or no TRADOC Form 377-R* Available	Type 3 Course Consolidation of Two Current Army Courses	Type 4 Course Consolidation of Two or More Courses Including Use of USAF or Navy POI	Type 5 Course Development of Entirely New Quasi-POI	Factors for Optional HCM Procedures
.1	.2	.3	.5 - .6	.7 - .8	.5 for Unit Training Analysis Time .5 for Training Concept Analysis Time .05 for Aptitude and Mental Category

*TRADOC Form 377-R contains Instructor Contact Hours (ICH) and is necessary for HCM Training Analysis.

A	B		C
Training Analysis Detailed Base-Analysis Time	Adjustment Factor		Training Analysis Data Collection and Analysis Time
(13 Type 1 Courses)	x	=	
(1 Type 3 Course)	x	=	
Unit Training Analysis Time	x	=	
Training Concept Analysis Time	x	=	
Aptitude Analysis Time	x	=	
Total Man-Days			
Total Man-Months			

WORKSHEET 8: Summary Table

A	B	C	D
HCM Step	Adjusted Base-Analysis Time (Worksheet 3, Col. D)	Data Collection and Analysis Time (Worksheets 4-7, Col. C)	Adjusted Base- Analysis Time
Systems Analysis	+	=	
Manpower Analysis	+	=	
Personnel Analysis	+	=	
Training Analysis	+	=	
Total Man-Months			

WORKSHEET 9: Analyst Skill Level Adjustment Factors

Analyst Skill Level	NOVICE	INTERMEDIATE	ADVANCED	INTERMEDIATE	EXPERT
	No HCM Experience	1-2 HCM Applications	2-5 HCM Applications	5 or More HCM Applications	
Factor	+ .5	+ .2	0	- .2	

A	B	C	D	E
HCM Step	Analyst Skill Level	Adjusted Base-Analysis Time (Worksheet 8, Col. D)	Adjustment Factor	Skill Level Time
Systems Analysis		x	=	
Manpower Analysis		x	=	
Personnel Analysis		x	=	
Training Analysis		x	=	

WORKSHEET 10: Summary Table

A	B	C	D
HCM Step	Adjusted Base- Analysis Time (Worksheet 8, Col. D)	Skill Level Time (Worksheet 9, Col. E)	Adjusted Base- Analysis Time
Systems Analysis		+	=
Manpower Analysis		+	=
Personnel Analysis		+	=
Training Analysis		+	=
		Total Man-Months	

WORKSHEET 11: Management Adjustment Factor

A	B	C	D	E
Adjusted Base-Analysis Time Total (Worksheet 10, Col. D)	Adjustment Factor	Management Time	HCM Step	Adjusted Base-Analysis Time
x	.2	=	Systems Analysis	=
			Manpower Analysis	=
			Personnel Analysis	=
			Training Analysis	=
			Management	=
			Total Man-Months	

WORKSHEET 12: Travel Requirements

A	B	C	D	E	F	G
Trip Number	Meeting Name	Meeting Time In Days	Travel Time In Days	Total Days	No. of People	Man-Days Total

Distribution of Travel Time by HCM Step

H	I	J
HCM Step	Man-Days	Man-Months
Systems Analysis		
Manpower Analysis		
Personnel Analysis		
Training Analysis		

WORKSHEET 13: Summary Table

A	B	C	D
HCM Step	Adjusted Base- Analysis Time (Worksheet 11, Col. E)	Travel Time (Worksheet 12, Col. J)	Adjusted Base- Analysis Time
Systems Analysis Manpower Analysis Personnel Analysis Training Analysis Management	+	+	=
	N/A	N/A	
		Total	Man-Months

WORKSHEET 14: Production Adjustment Factors

← (Less)		Analysis Complexity (More) →	
Missions	1 - 3	3 - 5	5 or more
Maintenance Levels	Crew/Org I Forward I Rear	Crew/Org I Forward I Rear	Crew/Org I Forward I Rear
MOS	1 - 5	5 - 10	10 - 20
Equipment	1 - 100	100 - 200	200 - 500
Report and Presentation Preparation Factor	.04	.06	.08

A	B	C	D
HCM Step	Adjusted Base-Analysis Time (Worksheet 13, Col. D)	Adjustment Factor	Production Time
Systems Analysis	x		=
Manpower Analysis	x		=
Personnel Analysis	x		=
Training Analysis	x		=

WORKSHEET 15: Summary Table

A	B	C	D
HCM Step	Adjusted Base-Analysis Time (Worksheet 13, Col. D)	Production Time (Worksheet 14, Col. D)	Total Analysis Time
Systems Analysis		+	=
Manpower Analysis		+	=
Personnel Analysis		+	=
Training Analysis		+	=
Management	N/A	N/A	
Total Man-Months			

ANALYST LEVEL	MONTHLY SALARY RANGE	ANALYST LEVEL	MONTHLY SALARY RANGE	ANALYST LEVEL	MONTHLY SALARY RANGE	ANALYST LEVEL	MONTHLY SALARY RANGE
Analyst/Engineer Level 1	\$2,000-\$2,500	Analyst/Engineer Level 2, 2-3 Years of HCM Experience	\$2,500-\$3,000	Analyst/Engineer Level 3-4, 3-5 Years of HCM Experience	\$3,000-\$3,400	Analyst/Engineer Level 4-5, 5-10 Years of HCM Experience	\$3,400-\$4,200

WORKSHEET 16: Direct Labor Calculation

A	B	C	D	E
HCM Step	Total Analysis Time (Worksheet 15, Col. D)	Analyst Skill Level (Worksheet 9, Col. B)	Monthly Salary	Total Direct Labor Costs
Systems Analysis				
Manpower Analysis				
Personnel Analysis				
Training Analysis				
Management				
			Total	

WORKSHEET 17: Contractor Travel Costs

A	B	C	D	E	F
Trip Number (Worksheet 12, Col. A)	Meeting Name (Worksheet 12, Col. B)	Meeting Time in Days (Worksheet 12, Col. C)	Destination	Total Days (Worksheet 12, Col. E)	No. of People (Worksheet 12, Col. F)
					Column F Subtotal

WORKSHEET 17: Contractor Travel Costs

G	H	I	J	K
Subsistence Cost, Contractor	Airport Parking	Rental Car	Personal Car Mileage Cost No. of Cars	Airfare
Column G Subtotal:	Column H Subtotal:	Column I Subtotal:	Column J Subtotal:	Column K Subtotal:

Total Travel Cost:

WORKSHEET 18: Determine Final Costs

A	B	C	D	E
Total Direct Labor Costs (Worksheet 16, Col. E)	Direct Labor Plus Overhead (Burdened Labor)	Burdened Labor Plus ODCs	Addition of G&A	Addition of Fee

Computation of Corporation X Job Cost

*** Other Direct Costs**

Travel
Material
Computer

Total ODC

Total Labor Overhead

Labor & Overhead

*Other Direct Costs (ODCs)

General & Administrative Cost

Fee

WORKSHEET 19: Automation Adjustment Factor

A	B	C	D
HCM Step	Total Analysis Time (Worksheet 15, Col. D)	Automation Adjustment Factor	Automation Time Savings
Systems Analysis	x	.4	=
Manpower Analysis	x	.6*	=
Personnel Analysis	x	.75	=
Training Analysis	x	.4	=

* The 60% time savings for manpower is based only on the time saved in performing a manpower analysis at the system development boundary.

WORKSHEET 20: Summary Table

A	B	C	D
HCM Step	Total Analysis Time (Worksheet 15, Col. D)	Automation Time Savings (Worksheet 19, Col. D)	Adjusted Total Analysis Time
Systems Analysis	-	-	=
Manpower Analysis	-	-	=
Personnel Analysis	-	-	=
Training Analysis	-	-	=
Management	N/A	N/A	

WORKSHEET 21: Impact Analysis Time Factors

HCM Step	1 - 3 MOSS & Courses	3 - 12 MOSS & Courses	12 - 24 MOSS & Courses	24 - 36 MOSS & Courses	36 - 50 MOSS & Courses
Manpower	3 days	3.5 days	4 days	5 days	5.5 days
Personnel	3 days	3.5 days	4 days	5 days	5.5 days
Training	8 days	12 days	15 days	18 days	20 days

A	B			C	D
HCM Step	Impact Analysis Time (from table above)	Analyst Skill Level Factor (Worksheet 9, Col. D)	Additional Impact Analysis Time for Analyst Skill Level		
Manpower	x	=			
Personnel	x	=			
Training	x	=			

WORKSHEET 22: Summary Table

A	B	C	D	E
HCM Step	Impact Analysis Time (Worksheet 21, Col. B)	Adjusted Analysis Time for Skill Level (Worksheet 21, Col. D)	Total Time for Impact Analysis	Convert Man-Days to Man-Months
Manpower	+	=		
Personnel	+	=		
Training	+	=		